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BULLETIN

OF THE

TORREY BOTANICAL CLUB

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SEPTEMBER, 1916

Studies of West Indian plants—VIII

NATHANIEL LORD BRITTON

44. FURTHER RECORDS OF JAMAICA SEDGES*

CYPERUS FUGAX Liebm. Vid. Selks. Skr. V. 2: 196. 1851

Savanna, Belle Vue, near Spanish Town (*Harris 12183*).
DISTRIBUTION: Mexico and Guatemala.

CYPERUS CYPEROIDES (L.) Kuntze, Rev. Gen. Pl. 3²: 333. 1898

Scirpus cyperoides L. Mant. 181. 1771.
Maviscus Sieberianus Nees, Linnaea 9: 286. 1834.
Maviscus cyperoides Urban, Symb. Ant. 2: 164. 1900. Not *M. cyperoides* A. Dietr.

Belle Vue, near Spanish Town, in wet hollows in pastures (*Harris 12045*); previously collected in Jamaica by Hart and by Wullschlaegel.

DISTRIBUTION: Trinidad. Native of the Old World tropics.

CYPERUS NANUS Willd.

In Bull. Dept. Agric. Jamaica 5: Suppl. 1, 9, I noted Mr. C. B. Clarke's record of this species from Jamaica, as based on the same specimen (*March 13*) as his record of *Mariscus gracilis* Vahl (*Cyperus granularis* [Desf.] Britton), and I subsequently ascertained that this specimen preserved in the Kew herbarium is

* Bull. Dept. Agric. Jamaica 5: Suppl. 1. 1907. Bull. Torrey Club 35: 568, 569. 1909. *Ibid.* 41: 1, 2. 1914.

[The BULLETIN for August (43: 397–440. *pl. 22, 23*) was issued August 22, 1916.]

C. granularis. It would therefore appear that *C. nanus* was entered as Jamaican by Mr. Clarke in error. *C. granularis* on the other hand is now known to me to inhabit dry soil at Long Acre Point near Black River (*Britton 1383*).

Cyperus ignotus sp. nov.

Perennial, glabrous; culm rather stout, smooth, bluntly 3-angled, about 5 dm. high. Basal leaves as long as the culm or longer, smooth, 2.5–4 mm. wide, those of the involucre similar, much longer than the inflorescence, sometimes 3 dm. long; umbel compound, its primary rays 8 cm. long or less; spikelets compressed, capitate, 6–8-flowered, the heads numerous, 8–10 mm. in diameter; rachis wingless; scales ovate-lanceolate, mucronulate, very faintly nerved, closely appressed and overlapping, 2 mm. long; style 3-cleft; achene oblong, trigonous, 1.3 mm. long, about twice as long as thick, narrowed at both ends.

In damp, shaded places, near Vinegar Hill, St. George, at about 1,100 m. alt. (*Harris 12350*). Plant with the habit of *C. elegans* L., but with flat leaves and quite different spikelets.

ELEOCHARIS NODULOSA (Roth) Schultes; R. & S. Mant. 2: 87. 1824

Scirpus nodulosus Roth, Nov. Pl. Sp. 29. 1821.

Swamp, Belle Vue near Spanish Town (*Harris 12179*).

DISTRIBUTION: Southern United States; Cuba; Hispaniola; Porto Rico; Antigua; Guadeloupe; continental tropical America.

ELEOCHARIS MICROCARPA Torr. (*E. minima* Kunth), was recorded by Mr. Clarke as collected in Jamaica by Purdie, but his determination of the specimen from the interior of Manchester preserved in the Kew herbarium was subsequently doubted by Mr. Clarke, and we have no other knowledge of the existence of this species in Jamaica.

Stenophyllus junciformis (HBK.)

Isolepis junciformis HBK. Nov. Gen. 1: 222. 1815.

Scirpus juncoides Willd.; Griseb. Fl. Br. W. I. 572. 1864.

Summit of Bull Head Mountain (*Underwood 3364*); Liguanea Ridge, St. Andrew (*Harris 12219, 12345*).

DISTRIBUTION: Cuba; South America.

Owing to two different species having been distributed as *Scirpus juncoides* under C. Wright's Cuban No. 1533, I formerly misidentified Professor Underwood's No. 3364 and recorded it* as *Stenophyllus subaphyllus* (Clarke) Britton, a species apparently restricted to eastern Cuba.

FIMBRISTYLIS MILIACEA (L.) Vahl, Enum. 2: 287. 1806

Savannas and swamps, Belle Vue, near Spanish Town (*Harris 12182, 12188*).

DISTRIBUTION: Southern United States; Cuba; Porto Rico; continental tropical America and Old World tropics.

RYNCHOSPORA OLIGANTHA A. Gray, Ann. Lyc. N. Y. 3: 212. 1835

Hollis savanna, Upper Clarendon (*Harris 12249*).

DISTRIBUTION: Southeastern United States. Not yet detected in Cuban savannas.

RYNCHOSPORA PUSILLA Chapm.; Curtis, Am. Jour. Sci. II. 7: 409. 1849

Rynchospora intermixta C. Wright; Sauvalle, Anales Acad. Habana 8: 88. 1872

Bull Head Mountain, along roadside in wet places (*Harris 12261*).

DISTRIBUTION: Southeastern United States; Santa Clara, Pinar del Rio and Isle of Pines, Cuba.

SCLERIA GRACILIS Ell. Bot. S. C. & Ga. 2: 571. 1824

Bull Head Mountain, 800–900 m. alt., forming small patches on exposed hillside (*Harris 12262*).

DISTRIBUTION: Southeastern United States; Pinar del Rio and Isle of Pines, Cuba.

45. STENOPHYLLUS RAF. IN THE WEST INDIES

Type species: *Scirpus Stenophyllus* Ell. The generic name dates from 1825 (Neog. 4). The name *Bulbostylis*, taken up by Mr. C. B.Clarke for the genus in 1893 (Hook. f. Fl. Brit. India) and subsequently, was first published by Kunth, under *Isolepis*, in 1837 (Enum. 2: 205).

* Bull. Dept. Agric. Jamaica 5: Suppl. 1, 12. 1907.

A. Spikelet solitary.
  Spikelet terminal, not subtended by a bract.
    Caudex stout, 2–15 cm. high, densely clothed with persistent leaf-bases. 1. *S. paradoxus.*
    Caudex none.
      Leaves elongated; spikelet straw-color. 2. *S. leucostachys.*
      Leaves short; spikelet dark brown. 3. *S. conifera.*
  Spikelet apparently lateral, subtended by a bract.
    Achene smooth. 4. *S. floccosus.*
    Achene papillose-reticulated.
      Achene twice as long as thick. 5. *S. portoricensis.*
      Achene scarcely longer than thick. 6. *S. curassavicus.*
B. Spikelets (except in depauperate plants) several or numerous.
  a. Spikelets in a single capitate cluster.
    Plants leafless or nearly so, or leaves 1–3 cm. long.
      Spikelets few, 6 mm. long or less.
        Leaf-blade 6 mm. long or less. 7. *S. subaphyllus.*
        Leaf-blade 1–3 cm. long. 8. *S. alpestris.*
      Spikelets several, 6–20 mm. long.
        Scales loosely pubescent. 9. *S. Wilsoni.*
        Scales glabrous or ciliolate. 10. *S. Tuerckheimii.*
    Leaves about one half as long as the culm. 11. *S. fimbriatus.*
  b. Spikelets in a simple or compound umbel, or sometimes compact or capitate.
    Spikelets clustered in umbelled heads or spikes, or head sometimes solitary.
      Culm pilose above. 12. *S. vestitus.*
      Culm glabrous.
        Scales mucronate by the excurrent midvein. 13. *S. junciformis.*
        Scales acute, the midvein not excurrent; achene papillose. 14. *S. antillanus.*
    Spikelets not clustered in the umbels, or somewhat clustered.
      Achene 0.5 mm. long, gray, densely pitted; scales suborbicular. 15. *S. coarctatus.*
      Achene 0.7–1 mm. long, white, transversely undulate; scales ovate. 16. *S. capillaris.*

1. STENOPHYLLUS PARADOXUS (Spreng.) Standley, Contr. U. S. Nat. Herb. **18**: 88. 1916

Schoenus paradoxus Spreng. Syst. **1**: 190. 1825.
Bulbostylis paradoxa Linden; Regnell, Cyp. 17. 1900.

TYPE LOCALITY: Mt. Silla de Cacares, near El Pexual, Venezuela.

DISTRIBUTION: Isle of Pines, Cuba: continental tropical America.

One of the noteworthy elements in the vegetation of sandy pine-lands on the Isle of Pines, sometimes occupying areas many acres in extent.

2. **Stenophyllus leucostachyus** (HBK.)

Isolepis leucostachya HBK. Nov. Gen. 1: 220. 1815.
Bulbostylis leucostachya Kunth; Clarke in Urban, Symb. Ant. 2: 85. 1900.

TYPE LOCALITY: Wet woods of the Orinoco at Maypuri.

DISTRIBUTION: West Indies (*Swartz*, according to Clarke): northern South America. Unknown to me from the West Indies.

3. **Stenophyllus coniferus** (Kunth)

Isolepis conifera Kunth, Enum. 2: 206. 1837.

TYPE LOCALITY: Surinam.

DISTRIBUTION: Recorded by Clarke as doubtfully collected by Mayerhoff in Hispaniola: northern South America.

4. STENOPHYLLUS FLOCCOSUS (Griseb.) Britton, Torreya 13: 216. 1913

Scirpus floccosus Griseb. Cat. Pl. Cub. 241. 1866.
Bulbostylis floccosa Clarke; Urban, Symb. Ant. 2: 86. 1900.

TYPE LOCALITY: Eastern Cuba.

DISTRIBUTION: Known only from the type locality.

5. STENOPHYLLUS PORTORICENSIS Britton, Torreya 13: 216. 1913

TYPE LOCALITY: Rocky coastal thicket near Guanica, Porto Rico.

DISTRIBUTION: Coastal thickets, southwestern Porto Rico.

6. **Stenophyllus curassavicus** Britton, nom. nov.

Bulbostylis floccosa var.(?) *pumilio* Clarke; Urban, Symb. Ant. 5: 290. 1907.

TYPE LOCALITY: Curaçao.

DISTRIBUTION: Banks and limestone rocks, Bonaire and Curaçao.

The spikelets of this species are much compressed. The

varietal name published by Mr. Clarke is not taken up because the plant attains a greater size than his description indicates. The plant is abundant about Willamsted, Curaçao (*Britton & Shafer 2946*).

7. STENOPHYLLUS SUBAPHYLLUS (Clarke) Britton, Bull. Dept. Agric. Jamaica **5**: Suppl. 1, 12. 1907

Bulbostylis subaphylla Clarke; Urban, Symb. Ant. **2**: 86. 1900.

TYPE LOCALITY: Eastern Cuba.

DISTRIBUTION: Eastern Cuba; formerly erroneously attributed by me (*loc. cit.*) to Jamaica (see page 443).

8. **Stenophyllus alpestris** (Urban)

Bulbostylis alpestris Urban, Symb. Ant. **7**: 168. 1912.

TYPE LOCALITY: Near Constanza, Santo Domingo, in pine-lands, 2,500 m. alt.

DISTRIBUTION: Known only from the type locality.

9. STENOPHYLLUS WILSONI Britton, Torreya **13**: 215. 1913

TYPE LOCALITY: Castle Island, Bahamas.

DISTRIBUTION: Castle Island and Little Inagua, Bahamas.

10. **Stenophyllus Tuerckheimii** (Urban)

Bulbostylis Tuerckheimii Urban, Symb. Ant. **7**: 169. 1912.

TYPE LOCALITY: Near Constanza, Santo Domingo, in pine-lands, 1,250 m. alt.

DISTRIBUTION: Known only from the type locality.

11. **Stenophyllus fimbriatus** (Nees)

Oncostylis fimbriata Nees; Martius, Fl. Bras. **2**: 88, 1843.
Scirpus Dussii Boeckl. Cyp. Nov. **2**: 38. 1890.
Bulbostylis fimbriata Clarke; Urban, Symb. Ant. **2**: 87. 1900.

TYPE LOCALITY: River-banks at Villa Rica, Brazil.

DISTRIBUTION: Martinique; Peru; Brazil.

12. **Stenophyllus vestitus** (Kunth)

Isolepis vestita Kunth, Enum. **2**: 210. 1837.
Oncostylis vestita Nees; Martius, Fl. Bras. **2**: 88. 1843.
Scirpus hirtus Griseb. Cat. Pl. Cub. 241. 1866.

TYPE LOCALITY: Surinam.

DISTRIBUTION: Province of Pinar del Rio, Cuba; western Porto Rico: continental tropical America. The Porto Rico plant was referred by Clarke to *Bulbostylis Langsdorffiana*.

13. STENOPHYLLUS JUNCIFORMIS (HBK.) Britton, Bull. Torrey Club **43**: 442. 1916

Isolepis junciformis HBK. Nov. Gen. **1**: 222. 1815.
Scirpus juncoides Willd.; Griseb. Fl. Br. W. I. 572. 1864.

TYPE LOCALITY: Near the Guachari cavern, 500 feet alt.

DISTRIBUTION: Savannas and pine-lands, province of Pinar del Rio, Cuba; Hispaniola; Jamaica; Trinidad: continental tropical America.

14. **Stenophyllus antillanus** sp. nov.

Culms tufted, nearly filiform, 2–4.5 dm. long, minutely rough-ciliolate or smooth. Leaves filiform, similar to the culm and one half to two thirds its length, rough-ciliolate or smooth, their sheaths pilose. Umbel compact or subcapitate; spikelets few or several, linear, 6–12 mm. long, 1.5 mm. wide, 8–12-flowered; scales ovate, known with a strong, whitish keel, acute, 1.5 mm. long; achene obovoid, nearly white, sharply trigonous, 0.7 mm. long, papillose, tipped by a minute, conic tubercle.

Dominica and Martinique. Type from Grand Savanna, Dominica (*F. E. Lloyd 822*).

Referred by Clarke (in Urban, Symb. Ant. **2**: 89. 1900) to *S. capillaris*.

15. STENOPHYLLUS COARCTATUS (Ell.) Britton; Small, Fl. SE. U. S. 189. 1903

Scirpus coarctatus Ell. Bot. S. C. & Ga. **1**: 83. 1816.

TYPE LOCALITY: Beaufort, South Carolina.

DISTRIBUTION: On a sand pile in Santiago Harbor, Oriente, Cuba, March, 1909; southeastern United States.

16. STENOPHYLLUS CAPILLARIS (L.) Britton, Bull. Torrey Club **21**: 30. 1894

Scirpus capillaris L. Sp. Pl. 49. 1753.
Bulbostylis capillaris Clarke; Hook. f. Fl. Brit. India **6**: 652. 1893.

TYPE LOCALITY: Virginia.

DISTRIBUTION: Sandy and rocky soil, provinces of Oriente and Pinar del Rio and on the Isle of Pines, Cuba; pinelands at high elevations in Santo Domingo; Jamaica (not recently collected): continental North America; temperate South America.

Stenophyllus tenuifolius (Rudge).

Scirpus tenuifolius Rudge, Pl. Guian. 18, *pl. 22.* 1805.
Scirpus bufonius Poir. Encycl. Suppl. **5**: 105. 1817.
Bulbostylis capillaris tenuifolia Clarke; Urban, Symb. Ant. **2**: 89. 1900.

Recorded by Clarke as collected by C. Wright in Cuba (*Wright 3382*), but our specimens of that number are not essentially different from *S. capillaris*. The species inhabits tropical South America.

46. GALACTIA P.BR. IN CUBA

Type species: *Glycine Galactia* L.

A. Corolla 2–2.5 cm. long, the standard parallel with the wings and keel. 1. *G. rudolphioides.*

B. Corolla not more than 1.7 cm. long, the standard erect, not parallel with the wings and keel.

a. Twining or trailing vines.

Corolla about 1.7 cm. long; leaflets 8 mm. long or less; peduncle 1-flowered. 2. *G. minutifolia.*

Corolla less than 1.5 mm. long; leaflets 1–6 cm. long; peduncles mostly few- to several-flowered.

Terminal leaflet (when 3) long-stalked.

Calyx-lobes longer than the tube.

Inflorescence short, 1- to few-flowered.

Branches prostrate; calyx loosely pubescent.

Leaflets 3 or 1, oblong to narrowly linear, 2–10 mm. wide. 3. *G. parvifolia.*

Leaflet only 1, ovate or elliptic, 10–18 mm. wide. 4. *G. monophylla.*

Branches suberect; calyx densely villous. 5. *G. suberecta.*

Inflorescence elongated, several- to many-flowered.

Leaflets membranous or chartaceous, flat, dull; standard 9–11 mm. long.

Leaflets oblong to obovate-oblong. 6. *G. Combsii.*

Leaflets ovate to elliptic or ovate-lanceolate.

Leaflets membranous; raceme usually long-peduncled. 7. *G. striata.*

Leaflets chartaceous; raceme short-peduncled or sessile. 8. *G. spiciformis.*

Leaflets subcoriaceous, revolute-margined, shining; standard 7 mm. long. 9. *G. Earlei.*

Calyx-lobes shorter than the tube.	10. *G. brachyodon.*
Leaflets nearly equally short-stalked.	
Leaflets densely or loosely pubescent beneath.	
Leaflets obovate, strongly reticulate-veined, loosely pubescent on both sides.	11. *G. Jenningsii.*
Leaflets linear-oblong, narrowed at both ends, densely silky beneath.	12. *G. revoluta.*
Leaflets glabrous, or with only some scattered hairs beneath.	
Flowering pedicels 1–2 mm. long; pod short-pilose, its pedicel 3 mm. long.	13. *G. galactioides.*
Flowering pedicels 0.5 mm. long; pod long-pilose, its pedicel 1.5 mm. long or less.	14. *G. savannarum.*
b. Erect shrub; leaflets 3.	15. *G. Jussiaeana.*

1. GALACTIA RUDOLPHIOIDES (Griseb.) Benth. & Hook.; Sauvalle, Anales Acad. Habana **5**: 337. 1869

Dioclea rudolphioides Griseb. Mem. Am. Acad. II. **8**: 178. 1860.
Galactia Odonia Griseb. Cat. Pl. Cub. 75. 1866.

Pinelands, thickets and hillsides, Oriente, Matanzas: Bahamas.

2. GALACTIA MINUTIFOLIA Urban, Symb. Ant. **2**: 325. 1900

Dry soil, Oriente. Endemic. Referred by Grisebach to *G. parvifolia* A. Rich.

3. GALACTIA PARVIFOLIA A. Rich. Ess. Fl. Cub. 414. 1845

Galactia stenophylla Urban, Symb. Ant. **2**: 313. 1900. Not H. & A.
Galactia parvifolia triphylla Urban, *loc. cit.* 314. 1900.
Galactia parvifolia heterophylla Urban, *loc. cit.* 315. 1900.
Galactia parvifolia monophylla Urban, *loc. cit.* 315. 1900.
Galactia Grisebachii Urban, Symb. Ant. **5**: 372. 1908.

Grassy fields and banks at lower elevations, all provinces and Isle of Pines: South Florida; Hispaniola. Consists of races differing in number, form and size of leaflets.

4. GALACTIA MONOPHYLLA Griseb. Cat. Pl. Cub. 75. 1866

Grassy places, Oriente, Havana; Bahamas.

5. **Galactia suberecta** sp. nov.

A somewhat woody trailing vine, with slender, villous, erect or ascending branches 1–2.5 dm. high. Stipules lanceolate, acute, 2–3 mm. long; petioles slender, villous, 1–2 cm. long; leaflets 3, oblong to oblong-oblanceolate or oval, 1–3 cm. long, mostly obtuse or rounded at the apex, appressed-pubescent on both sides, strongly reticulate-veined beneath, the lateral ones nearly sessile, obtuse or rounded at the base, the terminal one narrowed at the base, on a petiolule 3–4 mm. long; peduncles 1-flowered, shorter than the petioles; calyx villous, 6 mm. long, its lanceolate lobes longer than the tube; corolla purple, 1 cm. long.

Savanna near San Juan, Isle of Pines, Cuba (*Britton & Wilson 14973*).

6. GALACTIA COMBSII Urban, Symb. Ant. **2**: 219. 1900

Grassy places, Santa Clara, Pinar del Rio. Endemic. Referred by Combs to *G. angustifolia* HBK.

7. GALACTIA STRIATA (Jacq.) Urban, Symb. Ant. **2**: 320. 1900

Glycine striata Jacq. Hort. Vind. **1**: 32. *pl. 76*. 1770.
Galactia cubensis HBK. Nov. Gen. **6**: 429. 1823.
Galactia Berteriana DC. Prodr. **2**: 238. 1825.
Galactia striata cubensis Urban, Symb. Ant. **2**: 322. 1900.
Galactia striata Berteriana Urban, *loc. cit.* 1900.

Thickets and hillsides at lower elevations, all provinces and Isle of Pines: Jamaica; Hispaniola; Porto Rico; continental tropical America. Recorded by Grisebach and by Wright as *G. filiformis* Benth. Some Cuban specimens with short-peduncled inflorescence are only with difficulty separable from the following species. Races differ in pubescence.

8. GALACTIA SPICIFORMIS T. & G. Fl. N. A. **1**: 288. 1838

Thickets, Cays of Camaguey: southern Florida; Bahamas.

9. **Galactia Earlei** sp. nov.

Stem slender, somewhat woody, twining, finely appressed-pubescent 5 dm. long or longer. Stipules lanceolate-subulate, about 2 mm. long; petioles slender, sparingly pubescent, 3 cm. long or less; leaflets 3, oblong or elliptic, 1.5–3 cm. long, 8–15 mm. wide, glabrous and shining with the midvein impressed above,

sparingly appressed-pubescent beneath, revolute-margined, obtuse or slightly emarginate at the apex, rounded at the base, the terminal one with a petiolule 4–8 mm. long, the lateral ones nearly sessile; inflorescence stalked, slender, many-flowered, 6–12 cm. long, densely brownish-pubescent; flowers clustered, almost sessile; calyx 6–7 mm. long, densely brownish appressed-pubescent, its teeth longer than the tube, the upper one ovate, the others lanceolate; standard clawed, nearly orbicular, 7 mm. long.

Pine woods, Baracoa, Oriente (*Underwood & Earle 1342*).

11. **Galactia Jenningsii** sp. nov.

A very slender, slightly woody vine, the branches 1.5–3.5 dm. long, loosely pilose or glabrate. Stipules subulate, striate, about 1 mm. long; petioles slender, pilose, 3–10 mm. long; leaflets 3, nearly equally short-petioluled, obovate, oblong or oblong-obovate, subchartaceous, 6–20 mm. long, rounded or emarginate at the apex, rounded or narrowed at the base, pubescent on both sides, strongly reticulate-veined above; peduncles axillary, 1- to few-flowered, as long as the petioles or shorter; calyx pilose, about 6 mm. long, its lanceolate acuminate lobes about as long as the tube or a little longer; flowers purple; standard suborbicular, clawed, 7–8 mm. long; wings narrowly oblong, about as long as the standard; pod linear, short-beaked, appressed-pubescent, sessile in the calyx, 2.5 cm. long, 5 mm. wide.

White-sand pine-barrens, Isle of Pines, scarce and local (*Britton & Wilson 14,186*, type; *O. E. Jennings 350*).

10. GALACTIA BRACHYODON Griseb. Mem. Am. Acad. II. **8**: 178. 1860

Near Monte Verde, Oriente. Endemic.

12. GALACTIA REVOLUTA Urban, Symb. Ant. **2**: 333. 1900

Dry hillsides, northern Oriente. Endemic.

13. GALACTIA GALACTIOIDES (Griseb.) Hitchc. Rep. Mo. Bot. Gard. **4**: 77. 1893

Dioclea galactioides Griseb. Cat. Pl. Cub. 76. 1866.

Galactia impressa C. Wright; Sauvalle, Anales Acad. Habana **5**: 337. 1869.

Near Bahia Honda, Pinar del Rio, collected only by Wright. Endemic. Erroneously recorded from the Bahamas.

14. **Galactia savannarum** sp. nov.

A slender, somewhat woody vine, 6 dm. long or longer, rather densely pubescent with brownish reflexed hairs, or the older parts glabrate. Stipules lanceolate, acuminate, 1–2 mm. long; petioles slender, 5–10 mm. long; leaflets 1 or 3, oblong, oblong-lanceolate, or the terminal one oblong-oblanceolate, subcoriaceous, revolute-margined, 1–3 cm. long, 6–12 mm. wide, glabrous on both sides or with some scattered hairs beneath, obtuse or emarginate at the apex, rounded at the base, the pubescent petiolules equal, about 1.5 mm. long; inflorescence interruptedly spicate, slender, 5–12 cm. long, densely appressed-pubescent; flowering pedicels 0.5 mm. long or less; calyx 4–5 mm. long, appressed-pubescent, its lobes about equalling the tube; flowers blue-purple, about 8 mm. long; standard suborbicular, clawed, about 6.5 mm. broad; wings and keel nearly equal in length; pod borne on a pedicel about 1.5 mm. long, linear, acute, densely villous, 2.5–3 cm. long, 7 mm. wide.

Barren savannas, Oriente, Camaguey, Santa Clara. Type from savanna southeast of Holguin, Oriente (*Shafer 1237*).

15. GALACTIA JUSSIAEANA Kunth, Mimos. 196. 1824

Clitoria glomerata Griseb. Cat. Pl. Cub. 74. 1866.

Pine-lands and plains, Pinar del Rio and Isle of Pines: Jamaica; Hispaniola; tropical South America. Common in pine-lands on the Isle of Pines, attaining a height of 6 dm.

47. THE GENUS MACHAONIA H. & B. IN CUBA

Type species: *Machaonia acuminata* H. & B.

Fruit essentially glabrous.	
Fruit constricted below the middle.	1. *M. pauciflora.*
Fruit gradually narrowed to the base.	2. *M. littoralis.*
Fruit pubescent.	
Fruit sparingly pubescent, the persistent calyx-lobes long.	3. *M. trifurcata.*
Fruit densely pubescent, the persistent calyx-lobes short.	
Fruit broadly obpyramidal, 2.5 mm. long.	4. *M. microphylla.*
Fruit narrowly obpyramidal, 3–4 mm. long.	5. *M. calcicola.*

1. MACHAONIA PAUCIFLORA Urban, Symb. Ant. 5: 512. 1908

The species is based on part of *C. Wright's 433*, collected, presumably, in Oriente, and has not been found by us.

2. **Machaonia littoralis** sp. nov.

A shrub, about 2 m. high, with slender branches, the young twigs short-pilose, leafy to their tips. Leaves rhombic-ovate to

elliptic, 6–10 mm. long, subcoriaceous, entire, 7 mm. wide or less, abruptly acute, obtuse, or some of them rounded at the apex, narrowed at the base, glabrous, pinnately few-veined, the glabrous or somewhat pubescent petioles 0.5–1 mm. long; inflorescence corymbose-cymose, several-flowered; pedicels very slender, sparingly pubescent, 1–2 mm. long; fruit narrowly obpyramidal, sparingly papillose or glabrous, 2 mm. long, 1 mm. thick at the top, evenly gradually narrowed to the rounded base, the persistent calyx-lobes ovate or ovate-lanceolate, about 0.5 mm. long.

Coastal thickets, vicinity of Siguanea, Isle of Pines, Cuba (*Britton & Wilson 14942.*)

3. MACHAONIA TRIFURCATA Urban, Symb. Ant. **5**: 512. 1908

Cuba (*C. Wright 2760*). Referred by Grisebach to the Jamaican *M. cymosa* Griseb., but clearly different from that species. Not found by us. A part of *C. Wright 433* in the herbarium of the New York Botanical Garden has the characters of this species.

4. MACHAONIA MICROPHYLLA Griseb. Mem. Am. Acad. II. **8**: 510. 1862

Rocky hills at lower elevations in dry districts, province of Oriente.

A barren specimen, collected in the palm barren near the city of Santa Clara, Santa Clara province (*Britton & Wilson 6130*) is doubtfully referred to this species.

5. **Machaonia calcicola** sp. nov.

?*Spermacoce spinosa* Jacq. Stirp. Am. 21. 1763. Not L. 1762. Not *Machaeonia spinosa* C. & S.

?*Spermacoce havanensis* Jacq.; Gmel. Syst. 234. 1796.

A much-branched shrub or small tree up to 3 m. high, the slender twigs densely puberulent, bristle-tipped. Leaves ovate or rhombic-ovate to elliptic or oblong-lanceolate, 6–15 mm. long, acute, short-acuminate, or some of them obtuse at the apex, narrowed or obtuse at the base, glabrous, pinnately few-veined, the short petioles puberulent; inflorescence corymbose-cymose, several- to many-flowered; pedicels slender, pubescent, 1–2 mm. long, calyx densely pubescent, its ovate or ovate-lanceolate lobes as long as the tube or somewhat shorter; corolla white or yellowish, about 1 mm. long, its ovate-oblong obtuse lobes about as long as the

tube; stamens shorter than the corolla; fruit obpyramidal, 3–4 mm, long, 1.5 mm. thick at the top, tapering gradually to the base, densely pubescent, the persistent calyx-lobes about 0.5 mm. long.

Limestone rocks, northern parts of Havanna and Pinar de. Rio. Type from coastal hillside, Bay of Mariel, Pinar del Rio (*Britton & Earle 7619*).

A barren specimen from limestone rocks at Cape Corrientes (*Britton & Cowell 9894*) is doubtfully referred to this species.

48. THE GENUS HEPTANTHUS GRISEB.

A Cuban genus, of which three species were described at the place of original publication (Cat. Pl. Cub. 148. 1866); all were from western Cuba, *H. cochlearifolius* Griseb. being typical, and none have since been added to the genus. I now propose three others, all from eastern Cuba.

Leaf-blades glabrous above or merely puberulent.
- Peduncles longer than the leaves. — 1. *H. cochlearifolius.*
- Peduncles shorter than the leaves.
  - Leaf-blades orbicular-ovate, 1–2 cm. long; petioles densely villous. — 2. *H. cordifolius.*
  - Leaf-blades triangular- ovate, 4–6 mm. long; petioles sparingly villous. — 3. *H. Shaferi.*

Leaf-blades pubescent on both surfaces.
- Leaf-blades repand-dentate; peduncles much shorter than the petioles. — 4. *H. brevipes.*
- Leaf blades incised-serrate or lobed; peduncles as long as the leaves or longer.
  - Leaf-blades 12 mm. long or less, incised-serrate. — 5. *H. ranunculoides.*
  - Leaf-blades 1–2.5 cm. long, deeply 3-lobed, the lobes coarsely few-toothed. — 6. *H. lobatus.*

1. HEPTANTHUS COCHLEARIFOLIUS Griseb. Cat. Pl. Cub. 148. 1866

TYPE LOCALITY: Western Cuba.

DISTRIBUTION: Pine-lands and savannas, Pinar del Rio.

The upper leaf-surfaces are glabrous or nearly so.

A plant related in leaf-form, but with the upper leaf-surfaces densely puberulent is common in pine-lands and white sand in the central districts of the Isle of Pines, but could not be found in flower during our visit to this region in February and March, 1916 (*Britton & Wilson 14163*); it is therefore referred to this species with doubt.

2. **Heptanthus cordifolius** sp. nov.

In habit and aspect similar to *H. cochlearifolius*, forming cushion-like tufts 1–1.5 dm. broad. Petioles densely villous, 8 cm. long or less; leaf-blades orbicular-ovate, 1–2 cm. long, nearly or quite as wide as long, repand-dentate, rounded or obtuse at the apex, cordate at the base, distinctly punctate, glabrous above, villous on the few veins beneath; peduncles filiform, sparingly villous, shorter than the petioles; involucre campanulate, about 5-flowered; flowers white.

In damp soil among stones at edge of low thicket in deciduous woods near the base of Loma Mensura, Oriente, about 680 m. alt. (*Shafer 3786*).

3. **Heptanthus Shaferi** sp. nov.

Forming small tufts 4–6 cm. broad. Petioles filiform, loosely villous, 4 cm. long or less; leaf-blades triangular ovate, 4–6 mm. long, rather sharply few-dentate, bluntly acute at the apex, cordate at the base, distinctly punctate, glabrous on both sides or with a few hairs on the veins beneath; peduncle filiform, loosely villous, about 2.5 cm. long; involucre narrowly companulate, 4-flowered, about 1.5 mm. long.

On bank of a stream, Camp La Gloria, south of Sierra Moa, Oriente (*Shafer 8217*).

4. HEPTANTHUS BREVIPES Griseb. Cat. Pl. Cub. 148. 1866

TYPE LOCALITY: Low riparian woods near Toscano [Pinar del Rio].

DISTRIBUTION: Known only from the type locality and from the original collection (*Wright 2821*).

5. HEPTANTHUS RANUNCULOIDES Griseb. Cat. Pl. Cub. 148. 1866

TYPE LOCALITY: Western Cuba.

DISTRIBUTION: Known only from the original specimens (*Wright 2820*).

6. **Heptanthus lobatus** sp. nov.

Densely tufted, the tufts 1–1.5 dm. broad. Petioles densely villous, 7.5 cm. long or less; leaf-blades broadly ovate or orbicular-ovate in outline, pubescent with long hairs on both surfaces, 1–2.5 cm. long, deeply 3-lobed, the lobes coarsely few-toothed, the middle one obovate-cuneate, obtuse; peduncles filiform, loosely

villous, as long as the petioles or longer; involucre narrowly campanulate, about 3 mm. long, several-flowered; flowers white.

Sandy bank, alluvial valley of Rio Yamaniguey, Oriente (*Shafer 4201*).

49. UNDESCRIBED SPECIES FROM PORTO RICO

Malpighia Shaferi Britton & Wilson, sp. nov.

A shrub 2–2.5 m. tall, with grayish-brown twigs. Leaves oblong-elliptic to elliptic or somewhat oblong-lanceolate, 13–17 cm. long, 4.5–8.5 cm. broad, acute, or rounded and mucronate, or occasionally retuse at the apex, more or less inequilateral and acute or rounded at the base, reticulate-veined above, armed beneath with closely-appressed stinging hairs, the margin somewhat revolute; petioles stout, 8–12 mm. long; cymes nearly sessile; pedicels 8–18 mm. long; sepals elliptic to broadly ovate, 2–3 mm. long, 1.2–1.5 mm. broad; glands fully one half the length of the sepals; larger petals 10–11 mm. long, the blades 6 mm. broad, pink, prominently keeled on the back; stamens unequal; anthers cordate; styles unequal, the anterior one slightly shorter than the posterior ones; fruit red.

Type collected in the vicinity of Isabel Segunda, Vieques Island (*Shafer 2448*).

Byrsonima ophiticola Small, sp. nov.

Tree up to 8 m. tall, the twigs with dark gray bark, the young tips with dark red pubescence. Leaves clustered at the ends of the twigs, 3–6.5 cm. long, the blades spatulate to narrowly obovate, rounded or obtuse at the apex, closely and finely pubescent when young, sparingly pubescent when full-grown, dull, paler green beneath than above, acute or acuminate at the base, rather long-petioled; panicles 5–9 cm. long, the bracts less than 3 mm. long; pedicels closely pubescent, at least in anthesis; sepals ovate or oblong-ovate, 2.5–3 mm. long, obtuse or acutish, the glands mostly less than one half as long as the sepal-body; petals yellow, turning to scarlet, 8–10 mm. long, the blade broadly reniform or orbicular-reniform, 7–8 mm. wide, the claw shorter than the blades; drupes not seen.

Serpentine slopes, Guanajibo near Mayaguez (*Britton, Cowell, & Brown 4350*). Related to *Byrsonima lucida* DC., from which it differs in the longer petioles, larger panicles, and larger flowers. The petals besides unfolding yellow and turning scarlet, have relatively shorter claws and more broadly reniform blades than in *B. lucida*, and are of very firm texture and more persistent.

Chamaesyce Cowellii Millspaugh, sp. nov.

A small, prostrate, glabrous annual, many-stemmed from the rootstalk; stems short; branches filiform, 2–3 cm. long; nodes swollen and prominent. Inflorescence solitary in the upper axils. Leaves thick, sarcous, ovate, entire, blunt, 2–3.5×1.5–2 mm., strongly inequilateral at the oblique and but slightly cordate base, petiolate; stipules various, those of the upper surface mostly quadrilateral and often bilobed, others triangular, all lacerate; those of the under surface of the branches formless in laceration. Involucres turbinate, short-pedunculate, glabrous without, densely woolly within; lobes triangular, aristate, densely ciliate; sulcus shallow, inconspicuous, flanked by two minute lobes similar in form to the others; glands green, flattened parallel to the walls of the involucre; appendages narrow, greenish, crenate, about half the width of the glands. Capsule glabrous, deeply sulcate; seeds pink, ovate-quadrangular, the dorsal angle most prominent, 1×0.6 mm., the facets finely and anastomosely transverse-ridged in a central longitudinal line. Allied to *Chamaesyce serpens* (HBK.) Small.

Collected from the crevices of limestone rocks at Cayo Muertos (*Britton, Cowell & Brown 5007*). Type, sheet No. 427101, in the herbarium of the Field Columbian Museum.

Sebesten brachycalyx (Urban)

Cordia Sebestena brachycalyx Urban, Symb. Ant. 1: 389. 1899.

This tree, first made known from the southern and eastern coasts of Porto Rico, appears to differ specifically from the related *Sebesten Sebestena* (L.) Britton (*Cordia Sebestena* L.) of wide distribution in the West Indies, Florida and tropical continental America, and there much planted for ornament. *S. brachycalyx* has much rougher upper leaf-surfaces and a much smoother calyx than *S. Sebestena* (often glabrous), and its yellow or orange fruit is shorter-beaked than the white fruit of that species; the corolla of *S. brachycalyx* has a narrower limb than that of *S. Sebestena*. The species inhabits Porto Rico, Vieques, Culebra, and Buck Island, St. Thomas.

Crescentia portoricensis sp. nov.

A vine-like, glabrous shrub, with long, slender branches, the bark light gray. Leaves elliptic-obovate, fascicled at the nodes, 15 cm. long or less, 2–8 cm. wide, coriaceous, shining above, dull beneath, strongly reticulate-veined on both sides, abruptly short-

acuminate at the apex, cuneate at the base, the slender petioles 6–12 mm. long; peduncle 1–2 cm. long, slender in flower, much thickened in fruit; calyx 2 cm. long, deeply 2-lobed; corolla subcampanulate, 4 cm. long, yellowish white, reticulate-veined, its broadly ovate, entire, acute or blunt lobes about one fourth as long as the tube; fruit narrowly oblong, 10 cm. long, 3.5 cm. in diameter, terete, pointed at the apex, truncate at the base.

River-valley forests, mountains of western Porto Rico. Type from Rio de Maricao, 500–600 m. alt. (*Britton, Stevens & Hess 2455*).

Mikania Stevensiana sp. nov.

Climbing to a height of 5 m., the branches glabrous, striate, nearly terete, the twigs angular, sparingly pubescent. Leaves triangular-ovate in outline, firm in texture, brittle when dry, 5 cm. long or less, very scabrous and sparingly short-hispid above, pubescent on the elevated veins beneath, 5-nerved, sharply 3-lobed, the middle lobe triangular-lanceolate, long-acuminate, dentate, 3 or 4 times as long as the acute, entire or sparingly toothed, lateral ones; petioles sparingly pubescent, 1–2 cm. long; inflorescence corymbose-paniculate; heads peduncled; bracts of the involucre linear, acute, 7 mm. long; achenes angled, glabrous, 5 mm. long; pappus-bristles about 40; corolla 7 mm. long, as long as the pappus, its lobes acute.

Wooded valley, Maricao River, above Maricao (*Britton & Cowell 4225*, type; *Britton, Stevens & Hess 2439*).

50. UNDESCRIBED SPECIES FROM CUBA

Schoepfia cubensis Britton & Wilson, sp. nov.

A slender, glabrous shrub, 2.5–4 m. tall, the young twigs compressed, longitudinally ridged, often flexuose, glabrous. Leaves elliptic to oval, 2–3.4 cm. long, 1.5–2.8 cm. broad, short-petioled, entire, glabrous, rounded at the apex, equilateral and rounded or occasionally subcordate at the base, lustrous and rather indistinctly veined on both surfaces; principal veins 5 or 6 on each side of the midvein, strongly divergent; peduncles 0.8–1.2 cm. long; fruit sessile, ellipsoid, 8 mm. long, 7 mm. wide.

Camp La Gloria, Oriente (*Shafer 8278*).

Cassia scleroxyla sp. nov.

A slender tree, about 8 m. high, with smooth bark and exceedingly hard wood, the young twigs loosely appressed-pubescent.

Leaves glandular, 8–10 cm. long; petiole and rachis grooved above, sparingly appressed-pubescent; petiole 1–2 cm. long; leaflets 6–8 pairs, linear-lanceolate, chartaceous, 2–4 cm. long, acute and mucronate at the apex, rounded or narrowed at the base, rather dark green and glabrous above, pale green and sparingly pubescent beneath, the pubescent petiolules about 2 mm. long; flowers loosely corymbose; pedicels slender, puberulent, about 1 cm. long; sepals very unequal, sparingly pubescent, ciliate, the larger ones 4–5 mm. long; petals bright yellow, the larger 6–7 mm. long; perfect anthers 7, about 3 mm. long; pod linear, glabrous, 3–4.5 cm. long, 6–7 mm. wide, reticulate-veined, abruptly acute, septate between the seeds.

Hillside, Berraco, near Daiquiri, Oriente (*Britton & Cowell 12664*).

Among West Indian species, perhaps most nearly related to *C. domingensis* Spreng.

Cassia Shaferi Britton & Wilson, sp. nov.

Shrub 1 m. tall; twigs, petioles, rachis, and branches of the inflorescence hirsutulous. Leaves 6.5–10 cm. long, glandular, the gland slender, 1.5–2 mm. high, acutish or obtuse, situated either between the leaflets of the lowest pair or below on the petiole; petioles and rachis grooved; stipules narrowly oblong-lanceolate, 6–7 mm. long, acuminate; leaflets 4–6 pairs, oblong to elliptic, 1.5–3 cm. long, 7–12 mm. broad, rounded and mucronulate at the apex, rounded and very inequilateral at the base, sparingly hirsutulous on the midrib above, hirsutulous beneath, the hairs scattered and mostly appressed, short-petioluled; margin thickened, ciliate; pedicels hirsutulous; buds subglobose; sepals densely hirsutulous; pod flat, 11 cm. long, 9 mm. broad; seeds 3.5–4.5 mm. long.

Pine-lands near the base of Loma Mensura, Oriente (*Shafer 3770*); also collected in open places at base of Loma Mensura (*Shafer 3803*).

Apparently closely related to *Cassia bahamensis* Mill.

Pachyanthus reticulatus Britton & Wilson, sp. nov.

A shrub 1–1.5 m. tall; young twigs compressed, more or less grooved, ferruginous, stellately scabrous-puberulent. Leaves ovate, 9–12 cm. long, 5–7 cm. broad, obtuse at the apex, cordate at the base, above densely ferruginously stellate-puberulent when young, glabrescent, lustrous and dark green in age, the venation strongly impressed, below pale brown, reticulate-veined and

densely stellate-canescent, prominently 5-nerved; petioles 1.5–2.5 cm. long; flowers sessile, calyx campanulate, densely stellate-tomentulose, the lobes 5, deltoid at the base, linear above, 5–6 mm. long.

Low dry thickets, pine-lands, Sierra Nipe, near Woodfred, Oriente (*Shafer 2967*).

Labatia aristata Britton & Wilson, sp. nov.

A much-branched shrub, 2–3 m. high, the branches rigid, gray, the young twigs appressed-pubescent. Leaves broadly ovate to suborbicular, 2–3.5 cm. long, coriaceous, glabrous, strongly pinnately and reticulate-veined, dark green and shining above, dull green beneath, aristate at the apex, rounded or subcordate at the base, the yellowish green, rather stout petioles 5–10 mm. long; pedicels solitary or several together, slender, glabrous, 5–8 mm. long; calyx sparingly pubescent, 2.5–3 mm. long, deeply 4- to 5-lobed, the lobes lanceolate or oblong-lanceolate, acutish, scarcely imbricated; corolla green, about 2.5 mm. long, 4–5-lobed to about the middle, the lobes rounded, slightly imbricated; anthers oblong, a little longer than the filaments; staminodia obovate, somewhat longer than the filaments; drupe oval, dark purple, 2.5 cm. long, its flesh very thin; seeds 2, oblong.

Coastal hills and thickets, provinces of Oriente, Santa Clara and Havana, Cuba; type collected between the Rio Chorrera and Marianao, Havana (*Brother Leon 6230*).

Tournefortia Earlei sp. nov.

A shrub, 1–2 m. high, with long, slender branches, or vine-like and 3 m. long, the branches densely pubescent with short, soft, appressed hairs. Leaves narrowly linear, or linear-lanceolate, 3–7 cm. long, 2–6 mm. wide, acute or bluntish at the apex, densely appressed-pubescent above, densely white-tomentulose beneath, the petioles 1.5–3 mm. long; cymes short-peduncled, their few, very slender branches 2–4 cm. long; calyx 1 mm. long, appressed-pubescent, its lanceolate or ovate-lanceolate lobes acute; corolla-tube about 2 mm. long, the narrowly lanceolate lobes about as long; fruit depressed, 4 mm. broad, about one half as high as broad, glabrous.

Hillsides, Guantanamo Bay and Santiago Bay, Oriente. Type from Guantanamo Bay (*F. S. Earle 82*). Related to *T. incana* Lam. and *T. stenophylla* Urban.

Cestrum pinetorum sp. nov.

A glabrous shrub, about 1 m. high, with slender branches. Leaves narrowly oblong to oblong-lanceolate, 7 cm. long or less, 6–16 mm. wide, rather thin in texture, faintly shining, bluntly acute at the apex, narrowed at the base, the midvein slender above, prominent beneath, the lateral veins few, obscure, the slender petioles 3–5 mm. long; clusters axillary, few- to several-flowered; fruiting pedicels very short; fruiting calyx obconic-campanulate, about 5 mm. long, its triangular-ovate teeth acutish, about one third as long as the tube; berry globose-ovoid, purplish, about 7 mm. long.

Open pine-woods Sierra Nipe near Woodfred, Oriente, 500–650 m. alt. (*Shafer 3031*, type; *3591*).

Casasia parvifolia sp. nov.

A much-branched shrub, about 2 m. high, the twigs slender, puberulent when young. Stipules lanceolate, acute, about 3 mm. long. Leaves glabrous, oblong-spatulate, 3 cm. long or less, 5–8 mm. wide, obtuse or acutish at the apex, narrowed or cuneate at the base, coriaceous, clustered at the ends of the twigs, pinnately few-veined, shining and with impressed midvein above, the midvein very prominent beneath, the petioles about 1 mm. long; fruit terminal, solitary, sessile, globose, warty, about 10 mm. in diameter.

Rocky river-banks, mountains of northern Oriente; type collected between Camp La Barga and Camp San Benito, 450–900 m. alt. (*Shafer 4100*).

Baccharis Shaferi sp. nov.

A glabrous shrub, 6 dm. high or less, with slender ascending branches, the twigs angled. Leaves triangular-cuneate, 6–12 mm. long, 7 mm. wide or less at the truncate or subtruncate apex, bright green and shining above, dull and whitish-papillose beneath, the slender midvein slightly elevated on both sides, the lateral veins 1–3; heads sessile, solitary or 2 or 3 together at the ends of short twigs, or in the axils; young involucres about 4 mm. long, the ovate, acute bracts imbricated in about 4 series.

Dry pine woods, Arroyo del Medio above the falls, 450–550 m. alt., Oriente (*Shafer 3257*, type); specimens from Camp La Gloria, south of Sierra Moa, Oriente (*Shafer 8213*), have longer leaves than the type specimens.

51. UNDESCRIBED SPECIES FROM THE ISLE OF PINES, CUBA

Zamia silicea sp. nov.

Caudex slender, completely buried in sand, 2 dm. long or longer. Basal scales lanceolate, villous, 1–2 cm. long; leaves glabrous or the base of the petiole villous, spreading or ascending, 1–4 dm. long; leaflets 30 or fewer, coriaceous, shining, many-veined, obovate-oblanceolate, 3–6 cm. long, 2 cm. wide or less, rounded or obliquely subtruncate and callously denticulate at the apex, narrowed at the base; peduncles densely short-pubescent, 2–4 cm. long; male cone cylindric, about 3 cm. long and 1.3 cm. thick, its scales densely pubescent, hexagonal, the upper and lower ones about as wide as high, the middle ones nearly twice as wide as high; ripe pistillate cones ellipsoid, short-tipped, 5–6 cm. long, about 2.5 cm. thick, the hexagonal scales puberulent, seeds red, about 12 mm. long, broadly grooved on the inner side, rounded on the back, obliquely and obtusely umbonate at the apex.

Frequent in pine-lands and in white silicious sand. Type from near Los Indios (*Britton & Wilson 14166*).

Cyperus pinetorum sp. nov.

Perennial by short rootstocks; culms tufted, stiff and wiry, compressed, 1.5–2.5 cm. high. Basal sheaths striate-veined, acute, 2–4 cm. long; involucral leaves 1 or 2, nearly subulate, 0.5–3 cm. long; spikelets linear, 10–22 mm. long, 1.5 mm. wide, digitate, one cluster subtended by the involucral leaves with usually a similar one on a slender ray 4 cm. long or less; scales elliptic, obtuse, mucronulate, yellowish-brown, 1.5 mm. long; achene sharply trigonous, about 0.6 mm. long, nearly as thick as long, often persistent on the rachis after the scales have fallen away.

White sand pine barrens. Type from the vicinity of Los Indios (*Britton and Wilson 14170*).

Related to *C. Haspan* L., differing in broader spikelets, broader scales and proliferous inflorescence.

Xyris longibracteata Britton & Wilson, sp. nov.

Annual(?); leaves erect, linear, 8–10 cm. long, 1–1.5 mm. broad, occasionally somewhat spirally twisted, the margin rough; scapes several, erect, glabrous, 15–18 cm. tall, terete or nearly so; involucre subtending the spike composed of several bracts of unequal length, each tapering abruptly into a long, linear tip, the longest bract often exceeding the spike; spikes ellipsoid to ovoid, 7–9 mm.

long, 4–6 mm. broad; bracts ovate to orbicular-ovate, 4–5 mm. long, 3.5–4 mm. broad, acute at the apex; lateral sepals included; keel toothed from the apex to below the middle; petals broadly obovate, 5 mm. long, 3.5–4 mm. broad.

White sand, vicinity of Los Indios, Isle of Pines (*Britton, Britton & Wilson 14215*).

Chamaecrista micrantha sp. nov.

Stems several from a woody root, ascending or suberect, few-branched or simple, slender, villous, 2–3 dm. long. Stipules lanceolate acuminate, 2.5–4 mm. long; leaves 8–18 mm. long; petiolar gland short-stalked; rachis villous; leaflets 10–24, oblong, villous, 3–3.5 mm. long, mucronulate, the midvein very excentric; peduncles very slender, villous, 6–15 mm. long; sepals lanceolate, acute, villous, about 4 mm. long; petals rounded, 5 mm. long; pod linear, finely pubescent, 2–3 cm. long, 3–4 mm. wide.

Pine-lands and savannas, Pinar del Rio and Isle of Pines, Cuba. Type collected near San Pedro, Isle of Pines (*Britton & Wilson 14294*). Referred by Grisebach to *Cassia pygmaea* DC., and taken up by Bentham under *Cassia procumbens* L., but the type of *C. procumbens* is the same as *C. nictitans* L.

Chamaecrista savannarum sp. nov.

Stems several from a deep woody root, slender, ascending or erect, short-pubescent, 2–4 dm. high, simple or little-branched. Stipules lanceolate or ovate-lanceolate, 2–4 mm. long, acuminate, strongly veined; leaves 2.5 cm. long or less, the rachis pubescent; petioles 2–4 mm. long, bearing a scutellate, sessile or very short-stalked gland; leaflets 3–13 pairs, appressed-pubescent or glabrate, oblong or linear-oblong, 3–7 mm. long, somewhat oblique, aristulate, the midvein very excentric; peduncles slender or nearly filiform, 8–20 mm. long; sepals lanceolate, acuminate, slightly pubescent, 4–5 mm. long; petals 7–8 mm. long; pod linear, sparingly pubescent, 3–4 cm. long, 4 mm. wide.

Savannas and pine-lands, Pinar del Rio and Isle of Pines, Cuba. Type collected near Siguanea, Isle of Pines (*Britton & Wilson 14379*).

Bauhinia Jenningsii P. Wilson, sp. nov.

A slender shrub or tree, sometimes 5 m. high; young twigs, branches of the inflorescence, under surface of the leaves and pods finely puberulent with minute, mostly appressed hairs; petioles

1.5–2 cm. long; leaves lanceolate-ovate to oblong-ovate or ovate, 7–14 cm. long, 2.5–5 cm. broad, acute at the apex, subtruncate or rounded at the base, 5-nerved, finely reticulate-veined and glabrous above, reticulate-veined and minutely papillose beneath; inflorescence corymbose; flowers long-pedicelled; calyx scarlet, puberulent with appressed hairs; petals lanceolate or occasionally somewhat oblanceolate, 1.2–1.6 cm. long, 2–2.7 mm. broad; sterile stamens 9, half as long as the fertile stamen; ovary stipitate; pods oblong, 5–9 cm. long, 0.8–1.5 cm. broad, brown; seeds oblong-elliptic to elliptic, 7–8 mm. long, 5–5.5 mm. broad, brownish black.

Wooded limestone plain, Coe's Camp, Ensenada de Siguanea (*Britton & Wilson 14851*, type); coastal plain, San Juan (*Britton & Wilson 15544*); coral soil, north of Caleta Grande (*O. E. Jennings 480*).

Savia perlucens sp. nov.

A shrub, about 2 m. high, the slender branches terete, grey. Stipules ovate, acute; leaves obovate or elliptic-obovate, coriaceous entire, 9 cm. long or less, acute or acuminate at the apex, obtuse or acute at the base, bright green and strongly shining above, dull green beneath, the midvein prominent above and beneath, both surfaces reticulate-veined; flower-clusters supra-axillary, depressed, about 3 mm. broad, puberulent.

Limestone plain, Caleta Grande (*Britton, Wilson & Leon 15330*).

Phyllanthus nanus Millspaugh, sp. nov.

A low, spreading, glabrous perennial, about 5 cm. in extent, with thick, strongly imbricated leaves. Root thick, branching, giving off a mass of thread-like rootlets. Stems many, springing from the rootstalk, very short (1–1.5 cm.); branches diffuse, rather thick and striate, 1–2 cm. long. Inflorescence dioecious, biflorate, in the axils of the apical leaves of the short branchlets. Leaves thick, glabrous, ovate, cordate, acute, entire, 1.3×1–2.3×1.75 mm.; petioles very short; stipules entire, aristate from a deltoid base, the upper half withered to a dark brown color. Flowers sessile or nearly so; sepals 5, equal, ovate, acute, strongly striate-keeled; glands 5, verrucoid, minute; staminal column twice the length of the anthers; anthers 2, transversely connate in an apical ring; female calyx as in the male but nearly twice the size; ovary 3-carpelled, 6-celled, nearly sessile; styles 3, short, bifid to half their length, the stigmatic apices cleaveate; capsule depressed-globose, glabrous; seeds dark brown, sharply angled, 0.9×0.75 mm. dorsal facet minutely and closely transverse anastomose-wrinkled.

In white sand in the vicinity of Los Indios (*Britton & Wilson*

14192). Type sheet in the herbarium of the Field Columbian Museum.

Chamaesyce Jenningsii Millspaugh, sp. nov.

Prostrate, spreading from a low rootstock; stems many, divaricately branching, internodes about 1.5–3 cm.; branches 2 to many at each swollen node, wiry, divergently forking; leaves oval to ovate, 5×3–8×4 mm., glabrous above, finely long silvery-pubescent beneath, obliquely cordate, blunt, shallowly but sharply serrate throughout the margins. Inflorescence solitary in the terminal forks and axils; involucres long-turbinate, glabrous without, hairy within; pedicels about twice the length of the tube; lobes triangular; sulcus large, deep, triangular, the fundus unoccupied; glands nearly circular, flattened to the walls of the involucre; appendages none, or rarely merely a marginal line of the same color and texture as the glands; bracteoles as many as the stamens, ligulate, transparent. Capsule glabrous, ovoid; carpels strongly keeled; seeds ovate-quadrangular, 1.2×1 mm., angles sharp, facets sharply and anastomosely transverse ridged including deep, quadrangular pits.

Vivijagua (*O. E. Jennings 621*); type in the herbarium of the Carnegie Museum, Pittsburgh, Pennsylvania. Also in coastal sands at the same place (*Britton & Wilson 14690*).

Tapura obovata Britton & Wilson, sp. nov.

A tree 10 m. tall; young twigs and petioles minutely strigillose; leaves obovate, 3.5–7 cm. long, 1.5–4.4 cm. broad, rounded at the apex, cuneate to rounded-cuneate at the base, dull above, lustrous beneath and reticulate-veined, glabrous, short-petioled; flowers short-pedicelled; calyx-lobes 5, ciliate, sparingly appressed-pilose on the outside, the two outer lobes smaller than the three inner ones, broadly oblong-elliptic to oval, 2.5–3.2 mm. long, 2–2.2 mm. broad, the three inner lobes oval to suborbicular, 3.4–3.8 mm. long, 3–3.3 mm. broad; corolla-lobes 5, unequal, the three smaller lobes spatulate-obovate, 4–4.6 mm. long, 1.2 mm. broad, the two larger lobes spatulate, 4.6–5 mm. long, 2.2–2.5 mm. broad; filaments lanceolate-oblong to oblong; ovary pilose; style filiform, pilose, 3-lobed.

Savanna, Vivijagua (*Britton & Wilson 15607*, type); coastal plain, San Juan (*Britton & Wilson 15524*).

Calyptranthes pinetorum Britton & Wilson, sp. nov.

A depressed, glabrous, much-branched shrub 6 dm. high or less, 3–10 dm. broad, the twigs stout, gray, terete or nearly so. Leaves

opposite, thick-coriaceous, ovate to orbicular, flat, 1–3.5 cm. long, rounded or obtuse at the apex, cordate or subcordate at the base, bright green and shining above, pale green and dull beneath, densely punctate, the midvein prominent, the lateral veins faint, the stout petioles 1–2 mm. long; peduncles rather stout, somewhat longer than the leaves; inflorescence cymose, few- to several-flowered; young fruit sessile, subglobose, 2 mm. in diameter, the calyx-limb 2 mm. broad.

Pine-lands, central districts. Type from north of Los Indios (*O. E. Jennings 390*).

Related to *C. nummularia* Berg. of Hispaniola, *C. Maxoni* Britton & Urban of Jamaica, and *C. Boldinghi* Urban of St. Martin.

Evolvulus arenicola Britton & Wilson, sp. nov.

A diminutive perennial, with a slender, woody root, the few or solitary, simple or few-branched stems slender, appressed-pubescent, 2–5 cm. long, ascending or nearly prostrate. Leaves ovate to elliptic, 9–15 mm. long, puberulent or glabrate above, appressed-pubescent beneath, mostly obtuse or rounded at both ends, the midvein faint, the lateral veins wholly obscure, the pubescent petioles 1–2 mm. long; flowers 1 or 2 at the ends of the stems or branches; pedicels 5–8 mm. long, pubescent; sepals linear-lanceolate, acuminate, villous, 5 mm. long; corolla white, rotate, 9–12 mm. broad; obscurely lobed; stamens about one-half as long as the corolla; styles deeply 2-cleft; capsule subglobose, shorter than the sepals.

White sand, vicinity of Los Indios (*Britton & Wilson 14190*).

Gerardia pinetorum Britton & Wilson, sp. nov.

Acaulescent; leaves elliptic-ovate to elliptic, 1.5–2 cm. long, 5–8 mm. broad, rounded at the apex, cuneate or somewhat rounded at the base, hispidulous above and below with jointed hairs; petioles 1–1.5 cm. long, densely hispidulous; scape erect, 4–8 cm. high, more or less hispidulous with jointed hairs, the spikes few-flowered, 1–2 cm. high, the bracts lanceolate, 4–5 mm. long, ciliolate, long-acuminate; calyx-lobes subequal, narrowly lanceolate, 4–4.5 mm. long, 0.5–0.8 mm. broad, ciliolate; corolla rose-pink, glabrous, the tube cylindric, 5–5.5 mm. long, the limb subequally 5-lobed, the lobes broadly obovate to somewhat oval-obovate, 4.5–8 mm. long, 2.5–5 mm. broad.

Along the Los Indios River above Los Indios (*O. E. Jennings 456*).

Rondeletia calcicola sp. nov.

A glabrous shrub about 2 m. high, the twigs slender. Leaves coriaceous, narrowly oblong to oblong-oblanceolate, 5–13 cm. long, 8–18 mm. wide, shining above, dull beneath, acute at the apex, attenuate at the base into petioles about 1 cm. long or less, loosely reticulate-veined with the midvein prominent on the under surface; inflorescence terminal, few-flowered; fruiting pedicels rather stout, 3–7 mm. long; capsule oblong or oblong-obovoid, glabrous, 1 cm. long, about twice as long as thick; fruiting calyx-lobes ovate-lanceolate, acute, 1–1.5 mm. long.

Wooded limestone plain, Coe's Camp, Ensenada de Siguanea (*Britton & Wilson 14842*).

Diodia ciliata Britton & Wilson, sp. nov.

Stems perennial, prostrate, 4–6 dm. or more in length, rooting and partly buried in sand, densely pilose with whitish hairs on the younger growth; leaves elliptic to somewhat elliptic-obovate, 1.5–3 cm. long, 7–14 mm. broad, acute at the apex, cuneate to broadly cuneate at the base, the margin conspicuously and densely ciliate with rather stiff white hairs, yellowish green and glabrous above, the midvein and lateral veins inconspicuous, whitish-pilose beneath, especially on the midvein, sessile; stipules ciliate; ovary 2-celled; fruit elliptic-obovoid, 3 mm. high, glabrous, or with few scattered appressed hairs on the back.

In white sand, vicinity of Los Indios (*Britton & Wilson 15347*).

Diodia arenicola Britton & Wilson, sp. nov.

Perennial; stems ascending, 1–1.5 dm. high, glabrous; leaves lanceolate, 6–14 mm. long, 2–3 mm. broad, acute at the apex, rounded or somewhat acutish at the base, glabrous or with few, stout, scattered, mostly appressed hairs above, glabrous beneath, sessile; stipules linear-lanceolate, 2 mm. long; calyx lobes triangular-ovate, ciliate; corolla 5 mm. high, the lobes ovate, obtuse; anthers ovate-lanceolate; style 3-lobed; fruit ellipsoid, 2.5 mm. high, 1.2 mm. broad, glabrous.

Along arroyo, Los Indios, Isle of Pines (*O. E. Jennings 355* in part, type); vicinity of Los Indios (*Britton & Wilson 15812*).

Mitracarpum depauperatum Britton & Wilson, sp. nov.

A diminutive, woody perennial, 2–5 cm. high, forming small tufts, the stems few-branched or simple, the internodes very short. Leaves narrowly linear, 6–15 mm. long, less than 1 mm. wide,

densely clustered, acute, sessile, glabrous; stipules deeply laciniate, about one-third as long as the leaves; calyx very small; corolla salverform, white, its tube cylindric, 2.5 cm. long, its limb spreading, 4-lobed, the lobes ovate, acute, nearly 1 mm. long.

Dry white sand, central districts; type from near Los Indios (*Britton & Wilson 14197*).

Palicourea elongata Britton & Wilson, sp. nov.

A shrub 2 m. or more high; twigs, branches of the inflorescence, and pedicels minutely hispidulous with brownish hairs; leaves in whorls of threes, lanceolate or occasionally broadly oblanceolate, 12–19 cm. long, 4–6 cm. broad, acuminate at the apex, cuneate to somewhat rounded cuneate at the base, puberulent above on the midvein when young, puberulent beneath, especially on the midvein and lateral veins; stipules linear-lanceolate, 8–12 mm. long, ciliate; panicle elongate, 7–19 cm. high; calyx-lobes deltoid-ovate, ciliate; corolla puberulent, 7–10 mm. long, the lobes triangular-ovate; fruit broadly ovoid, 4–5 mm. long, 4–4.5 mm. broad, flattened.

Arroyo, Las Tunas (*Britton & Wilson 14749*, type); Arroyo, vicinity of San Pedro (*Britton & Wilson 15785*); Los Indios (*O. E. Jennings 332*).

Elephantopus arenarius Britton & Wilson, sp. nov.

Plant 6–8 cm. high, the stem branching from the base; leaves cauline, linear, 2–4 cm. long, 1 mm. broad, involute, conspicuously ciliate at the broadened, clasping base with long hairs, entire; peduncles loosely hirsutulous, 2–3.5 cm. long; glomerules 5–6 mm. high; bracts broadly ovate to ovate-orbicular, cordate at the base with a linear, ligulate tip, 0.5–1 cm. long, reticulate-veined on the back, glabrous; scales acuminate, glabrous; achenes (immature) 2 mm. long; pappus-scales triangular to lanceolate, ciliate.

White sand, vicinity of Los Indios (*Britton & Wilson 14206*).

Closely related to *Elephantopus pratensis* C. Wright, but differing in the narrow involute leaves and linear ligulate tipped bracts.

Erigeron purpuripes Britton & Wilson, sp. nov.

A low, scapose perennial. Leaves tufted, erect, the blades elliptic to oblong-obovate, 1–2 cm. long, pinnately few-veined, obtuse at the apex, narrowed at the base, ciliolate, puberulent or glabrate; petioles very slender, purple, 2 to 4 times as long as the blades; scapes nearly filiform, erect, appressed-pubescent, about

twice as long as the leaves; involucre 4 mm. high, subcylindric, its bracts in 2 or 3 series, linear, puberulent, the outer shorter than the inner; ligules white; disk-flowers tubular, 5-lobed, the lobes obtuse; achenes flattened, oblong or somewhat oblong-elliptic, minutely hispidulous; pappus-bristles in 1 series, barbellate.

In white sand, vicinity of Los Indios (*Britton & Wilson 14207*).

Helenium scaposum sp. nov.

A low, pubescent, scapose perennial. Leaves several or many, densely tufted, short-petioled, oblong to spatulate, punctate, 1.5–3 cm. long, 6–10 mm. wide, rather strongly 5- to 7-nerved, entire or repand-dentate, obtuse or acute at the apex, narrowed or cuneate at the base; scapes rather stout, 5–11 cm. high; involucre about 5 mm. high; its bracts ovate-lanceolate, acute, appressed or little spreading; rays 10 to 12, bright yellow, obovate, 3-toothed, 5–8 mm. long; disk yellowish, depressed-globose, 8–12 mm. in diameter, its corollas 5-lobed, the lobes triangular-ovate; pappus scales of ray-flowers and disk-flowers alike, elliptic to obovate, lacerate, not aristate.

White sand pine-lands, west-central districts. Type from near Siguanea (*Britton & Wilson 14346*).

A plant with quite the floral structure of *Helenium*, but its scapose habit is aberrant, resembling that of some *Tetraneuris* species.

New or interesting algae from the lakes of Wisconsin

GILBERT MORGAN SMITH

(WITH PLATES 24–26)

The present paper embodies various notes that have accumulated in a study of the algae of Wisconsin lakes for the Wisconsin Natural History and Geological Survey. Although a systematic account of the algae found has been prepared, it has been thought advisable to publish descriptions of the new species and notes on certain other species at this time.

Chaetosphaeridium ovalis sp. nov.

Thallus of five to twenty cells, epiphytic upon filamentous Chlorophyceae, gelatinous sheath indistinct. Cells ovoid, with two parietal chloroplasts each containing a pyrenoid. Sheath at the base of setae conspicuous.

Cells 22–20 μ long, 15–13 μ wide; length of setae about 125 μ; basal sheath of setae 15×3 μ.

PLATE 24, FIG. 1

DISTRIBUTION: along shore, Marion Lake.

The two species of the genus that are generally recognized, *C. globosum* (Nords.) Klebh. and *C. Pringsheimii* Klebh., are found also in the lakes of the state. *C. ovalis* resembles *C. Pringsheimii* forma *conferta* Klebh. in the arrangement of its cells, but the cell-shape is quite different. This species also differs from the others since it is the only one which regularly has more than a single chromatophore, while the basal sheath of the bristle is also more conspicuous in this than in the other species.

Oocystis panduriformis minor var. nov.

Cells 35–30 μ long; maximal diameter 15–12 μ, median diameter 14–11 μ.

PLATE 24, FIG. 2

DISTRIBUTION: plankton, Star Lake.

The type form, described by W. and G. S. West,* is nearly twice as large as the dimensions given above. The peculiar median constriction and the numerous chromatophores, however, show that the above described alga should be considered a variety of *O. panduriformis* W. West.

TETRASTRUM APICULATUM (Lemm.) Brunnthaler

Staurogenia apiculata Lemm. Bot. Centralbl. **76**: 151. 1898; Forschungsb. Biol. Stat. Plön **7**: 119. *pl. 1, f. 14.* 1899; Schmidle, Ber. Deutsch. Bot. Ges. **18**: 157. 1900.

Tetrastrum apiculatum Brunnthaler; Pascher, Süsswasser-flora Deutschlands, Österreichs und der Schweiz. **5**: 177. *f. 258.* 1915.

PLATE 24, FIG. 3

I have observed this alga twice in the plankton of Lake Mendota. Some investigators follow Schmidle in placing *Tetrastrum* as a subgenus of *Crucigenia* Morren, but in my opinion the two genera are distinct.

CHARACIUM STIPITATUM (Bachmann) Wille

Chlamydomonas stipitata Bachmann, Arch. Hydrobiol. u. Planktonkde. **3**: 81. *f. XI*^{1}–*XI*^{15}. 1908.

Characium stipitatum Wille; Engler & Prantl, Nat. Pflanzenfam. **1**^{2} (Nachtr.): 45. 1911; Brunnthaler in Pascher, Süsswasser-flora Deutschlands, Österreichs und der Schweiz **5**: 81. *f. 26.* 1915.

PLATE 24, FIGS. 4–6

This peculiar species was previously known only from Scotland, where it was described as a *Chlamydomonas* species. I have found it in the plankton of three lakes, Minocqua, Pardee and Sisebogema, in the northern part of the state. There is but little doubt that this is the same organism as that described by Bachmann, since the cell-shape and dimensions agree and it is only found epiphytic upon the same alga, *Coelosphaerium Naegeliana* Unger (*Gomphosphaeria Naegeliana* Lemm.).

The alga is entirely enclosed by the gelatinous envelope of the *Coelosphaerium* colony and does not, as Bachmann describes, merely have its stipe in the envelope. The figure copied by Brunn-

* Jour. Roy. Micr. Soc. **1894**: 15. *pl. 2, f. 33–35.* 1894.

thaler is not typical since the pyrenoid is never outside of, but always within, the chromatophore.

Kirchneriella elongata sp. nov.

Colonies of four, eight, sixteen, or many cells embedded in a copious homogeneous matrix. Cells cylindrical, rounded at ends, spirally or irregularly twisted into a knot-like snarl. Chloroplast single, parietal, without (?) a pyrenoid.

Colonies up to 100 μ in diameter. Cells 25–15 μ long, 2.75–2.00 μ wide.

PLATE 24, FIG. 7

DISTRIBUTION: plankton, No Mans Lake; along shore, Plum Lake.

This species approaches *K. contorta* (Schmidle) Bohlin, which I have collected from four Wisconsin lakes, but the cells are larger, some being twice as long as those of *K. contorta*, and there are usually more cells to the colony.

SCHROEDERIA SETIGERA (Schröder) Lemm.

Reinschiella setigera Schröder, Ber. Deutsch. Bot. Ges. **15**: 489. *pl. 25, f. 4.* 1897.

Schroederia setigera Lemm. Hedwigia **37**: 311. 1898.

Raphidium setigerum W. & G. S. West, Trans. Yorkshire Nat. Union **25**: 122. 1901.

Ankistrodesmus setigerus G. S. West, Brit. Freshw. Algae 224. *f. 94F.* 1904.

PLATE 24, FIG. 8

An organism found in the plankton of Devil's Lake agrees very well with the original description of *S. setigera*, with one exception. Schröder and the Wests appear to be the only ones who have observed the living plant and neither mentioned the disc at the end of one of the prolonged apices. There is no doubt in my mind but that this structure was present in the cells they studied, but since it is practically invisible under a magnification of six hundred diameters or less, they probably overlooked it.

An apparently closely related form is *Ankistrodesmus nitzschioides* G. S. West,* which has also been figured by Printz.† It differs

* Jour. Linn. Soc. Bot. **38**: 140. *pl. 5, f. 18.* 1907.

† Skr. Vidensk. Kristiania, Math.-Naturvid. Kl. **1913**[6]: 97. *pl. 7, f. 217–220.* 1914.

only in the lack of a pyrenoid and the terminal disc. G. S. West and Brunnthaler place the species in the genus *Ankistrodesmus*. Although the shape of the cells shows a great resemblance to that of *Ankistrodesmus* I believe that the retention of the genus *Schroederia* is to be preferred. If this species with the fine hair-like terminal processes can be shown to reproduce in the same manner as *Ankistrodesmus*, *Schroederia* should be considered a synonym; but since, in my observations on over a thousand individuals, I have never found autospores within the mother cell wall (a condition occurring abdundantly in all species of *Ankistrodesmus*), I am convinced that this species does not reproduce in the same manner as *Ankistrodesmus*. On the other hand the disc-shaped end of one of the apical processes suggests that the species may be an epiphytic *Characium*, possibly like *C. limneticus* Lemm. At first I considered it an epiphytic form that had broken off but since the examination of so many individuals has not shown any attachment to other plankton, it must be assumed to be naturally free-floating and not accidentally detached.

Schroederia Judayi sp. nov.

Cells fusiform, straight or curved, ends attenuated into hair-like projections, one of which terminates in a disc. Chromatophore single, parietal, with one pyrenoid.

Length, with spines, 63–45 μ, without spines, 30–14 μ; breadth 6–2.5 μ; width of terminal disc 4–2 μ.

PLATE 24, FIGS. 9–11

DISTRIBUTION: plankton, Birch, Kawaguesaga, Kegonsa and Mendota Lakes.

This species resembles the Egyptian *Ankistrodesmus setigerus* forma *minor* G. S. West but is somewhat longer, twice as wide, and never lacks a pyrenoid. It is named after Mr. Chauncey Juday, who first called my attention to it.

Gloeocystopsis gen. nov.

Cells elongate, cylindrical, more or less curved, with rounded ends. Cells aggregated in fours or eights within a non-lamellated, sharply defined, spherical, gelatinous sheath. Colonies of an indefinite number of these aggregates arranged in a spherical or ovoid mass. Chromatophore diffuse, assimilation product starch.

Reproduction, aside from cell division, unknown. (Name from *Gloeocystis* and ὄψις, appearance.)

This genus combines the general external morphological characteristics of *Gloeocystis* Naegeli and the cell shape of *Nephrocytium* Naegeli. Although ovoid cells have been described in species of *Gloeocystis*, the cells of this species are too markedly lunate to be classed with *Gloeocystis*. The enveloping mucilaginous mass around the cell aggregates is not lamellated as in *Gloeocystis*, neither is there a common gelatinous envelope for these aggregates. On the other hand although the cell-shape resembles certain *Nephrocytium* species (*N. allantoideum* Bohl. for example) the ovoid colonies of *Nephrocytium* are not composed of distinct aggregates of cells, each with its own envelope.

A further study of the method of reproduction, whether by autospores or zoospores, will determine the exact systematic position of the genus. From the data at hand the natural inference is that it should be placed in the vicinity of *Gloeocystis*.

Gloeocystopsis limneticus sp. nov.

Cells 15–10 μ long, 6–4 μ wide. Cell aggregates 30–25 μ in diameter. Colonies up to 125 μ in diameter.

PLATE 24, FIG. 12

DISTRIBUTION: plankton, Catfish and Harris Lakes.

The alga was found in two lakes in northern Wisconsin which are about fifty miles apart and on different watersheds. The dimensions of the alga are the same in both stations. It is probable that *Gloeocystis Rehmanni* Woloszynska from Africa is another species, but since the original description is very vague and no cell-dimensions are given, it must remain a doubtful species until more fully described.

Pediastrum sculptatum sp. nov.

Colonies oval or circular discs of eight to thirty-two cells. Interior cells four- to six-sided with few interstices between the cells. Marginal cells bilobed, with the lobes produced into divergent or parallel horn-like processes. Cell wall covered with a network of very fine ridges.

Diameter of colonies 150–80 μ; diameter of cells 15–10 μ.

PLATE 25, FIG. 13

DISTRIBUTION: plankton, South Turtle Lake.

The shape of the cells in this species resembles *P. Boryanum* (Turp.) Menegh. but the markings are decidedly different. The nearest approach in cell-marking is found in *P. araneosum*, but reticulations in this species are much coarser.

Pediastrum araneosum (Raciborski) comb. nov.

Pediastrum angulosum var. *araneosum* Raciborski, Verh. u. Sitzungsb. Akad. Wiss. Krakau **20**: 101. 1889.

DISTRIBUTION: plankton, Devil's Lake; along shore, Beaver and Muskallonge Lakes.

This has been regarded as a variety and not a distinct species. In my opinion the coarsely reticulate structure of the wall, which is correlated with a certain cell-shape, is sufficiently distinctive to warrant regarding it as a distinct species and not as a variety of some other species.

Pediastrum araneosum rugulosum (G. S. West) comb. nov.

Pediastrum Boryanum var. *rugulosum* G. S. West, Jour. Linn. Soc. Bot. **38**: 132. *pl. 5, f. 22.* 1907.

PLATE 25, FIG. 14

DISTRIBUTION: plankton, Meta Lake.

With the recognition of *P. araneosum* as a species the variety *rugulosum* very naturally comes under this species instead of *P. Boryanum*.

Peroniella planctonica sp. nov.

Cells single, gregarious, epiphytic upon cells of, and embedded in, mucilaginous envelopes of *Sphaerozosma*. Cell-shape ovoid-pyriform, with a long delicate stipe. Chromatophore single (rarely two), yellow-green in color, without pyrenoid or starch. Reproduction by division of cell contents into two to four zoospores with one (?) cilium.

Length of cell, without stipe, 9.5–6 μ; with stipe, 18–15 μ; stipes 10–8$\times$1.2 μ.

PLATE 25, FIG. 15

DISTRIBUTION: on *Sphaerozosma* sp., in plankton of Devil's Lake.

The genera *Peroniella* Gobi and *Stipitococcus* W. & G. S. West are quite similar but differ in that the cells of the latter are apiculate or irregularly expanded at the apex and are not ovoid. Since the apices of the cells are rounded in the above described alga it belongs to the genus *Peroniella*. It differs from the single known species, *P. Hyalothecae* Gobi, in that the cells are ovoid and smaller.

A study of the cell contents shows that the genus should be classified with the Heterokonteae and not with the Chlorophyceae. The chromatophores are without starch or pyrenoids and have a decided yellowish green color. Numerous oil droplets, which are probably the product of assimilation, are scattered throughout the cytoplasm. Few instances of zoospore formation were found, but those that were showed no lateral rupture through which the zoospores escaped, as Gobi* describes for *P. Hyalothecae*. Only one cilium was observed although a very careful search was made for a second shorter one. In this respect it resembles certain other Heterokonteae.

Chodatella ciliata minor var. nov.

Cells ovoid, with eight to six bristles at each end.
Cells 10–8 μ long, 7.5–6 μ wide; bristles about 20 μ in length.

PLATE 25, FIG. 16

DISTRIBUTION: plankton, Muskallonge Lake.

The cells of this species are about the same size as those of *C. subsalsa* Lemm., but the number of terminal bristles is that of *C. ciliata* (Lagerh.) Lemm. The variety *minor* never reaches the minimal limit of the type form.

MICRACTINIUM PUSILLUM Fresenius

Micractinium pusillum Fresenius, Abh. Senckenberg. Naturf. Ges. **2**: 236. *pl. 11, f. 46–49.* 1858; Lemm. Ber. Deutsch. Bot. Ges. **22**: 21. 1904; Wille in Engler & Prantl, Nat. Pflanzenfam. 1^2 (Nachtr.): 57. 1911.

Archerina Boltoni Lankester, Quart. Jour. Micr. Sci. N. S. **25**: 61. *pl. 7, f. 1–23.* 1885; *l.c.* **52**: 423. 1908.

Golenkinia botryoides Schmidle, Allg. Bot. Zeitschr. **2**: 194. 1896.

Golenkinia fenestrata Schröder, Ber. Deutsch. Bot. Ges. **15**: 492. *pl. 25, f. 5.* 1897.

* Scripta Bot. Hort. Univ. Petrop. **2**: 233–255. *pl. 1.* 1886–1887.

Richteriella globosa Lemm. Forschungsb. Biol. Stat. Plön **5**: 107. 1897.

Richteriella botryoides Lemm. Hedwigia **37**: 307. *pl. 10, f. 1–6.* 1898; Arch. Hydrobiol. u. Planktonkde. **5**: 306. 1910.

Richteriella botryoides forma *fenestrata* Chodat, Matér. pour la Flore Crypt. Suisse 1^3: 194. *f. 110.* 1902.

Richteriella botryoides forma *tetraedrica* Lemm. Arch. Hydrobiol. u. Planktonkde. **5**: 307. 1910; Ber. Deutsch. Bot. Ges. **18**: 90. *pl. 3, f. 9–10.* 1900.

PLATE 25, FIG. 18

This alga is most widely known as *Richteriella botryoides*, a name which is untenable under any circumstance. In 1904 Lemmermann pointed out that the overlooked genus *Micractinium* Fresenius bears considerable resemblance to *Richteriella* Lemm. He thinks, however, since the description is so vague and most of Fresenius's figures illustrate only single cells, that the organism Fresenius saw was what is commonly called *Golenkinia*. Wille holds that all of the spherical-celled forms with radiating bristles constitute a single genus and makes the subgenus *Golenkinia* for the solitary forms and *Richteriella* for the colonial ones. He very logically applies Fresenius's name *Micractinium* to this composite genus.

In my opinion the colonial and solitary habits are too diverse to warrant placing both of them in the same genus. The question then arising is, shall *Micractinium* be substituted for *Golenkinia* or for *Richteriella?* Lemmermann's account (1904) creates the impression that Fresenius's description fits *Golenkinia* better than *Richteriella*. The cell measurements given by Fresenius, 1/170–1/150 mm. (5.88–6.67 μ) as a maximal and 1/300 mm. (3.33 μ) or less as the minimal dimensions, are much nearer *Richteriella botryoides* than *Golenkinia radiata* Chodat or any other *Golenkinia* species. It must be admitted that Fresenius does not emphasize the colonial habit, which characterizes *Richteriella*, but he does state that colonies of two to four cells are found and that there may be more than four cells in the colony so that a berry-shaped (mulberry?) colony is formed. Since *Golenkinia* forms only temporary colonies and since these never contain more than four cells it seems to me that the organism Fresenius saw is the one which Lemmermann has described as *R. botryoides*.

Lankester states that the genus *Archerina* antedates *Richteriella*. There is no question of the identity of the two organisms, *f. 21* of Lankester's plate being especially characteristic. In the material studied by Lankester he mistook a naked amoeboid parasite investing the plant cells for an integral part of the organism and so considered *Archerina* a protozoan and not an alga. The name *Richteriella* cannot be retained in any case, since those who regard the description of *Micractinium* as being too vague should use *Archerina* in its place.

This alga, which I have found in abundance in some of the local lakes, at times forms large irregular colonies containing over a thousand cells. The most common state, however, is the flat plate of sixteen cells with an open central space, the form *afenestrata* Chodat. This name and also the form-name *tetraedrica* Lemmermann are unwarranted since they may both occur in the same colony.

Micractinium quadrisetum (Lemm.) comb. nov.

Richteriella quadriseta Lemm. Hedwigia **37**: 307. *pl. 10, f. 7.* 1898.
Richteriella botryoides var. *quadriseta* Chodat, Matér. pour la Flore Crypt. Suisse 1^3: 194. 1902.

PLATE 25, FIG. 17

DISTRIBUTION: plankton, Catfish and Cranberry Lakes.

The character on which the specific name is based, that of four spines, is not constant enough to warrant the establishment of a separate species. It is probably on this account that several investigators have followed Chodat's lead and considered it a form hardly worthy of naming. On the other hand the cell is always distinctly ovoid in this species, whereas it is always spherical in *M. pusillum*. The cell-dimensions in *M. quadriseta* are also always constantly larger. Since there are these differences *M. quadriseta* should be considered a distinct species.

Tetraedron planctonicum sp. nov.

Cells four- or five-sided, sides generally incurved and equal. Angles of cells prolonged into bifurcate or trifurcate processes ending in two or three horns. Processes broad in top view, narrow in side view.

Diameter of cell without processes 24–18 μ; with processes (diagonally) 70–50 μ; diameter of processes 12–9×8–5 μ; length 25–15 μ.

PLATE 26, FIGS. 19–20

DISTRIBUTION: plankton, Cranberry, Lost, No Mans and Pardee Lakes.

This striking form is confined to the plankton of lakes in the northern part of the state. It resembles *T. limneticum* Borge to a certain extent but agrees more nearly with the description of *T. gracile* (Reinsch) Hansg. The processes differ from those of *T. gracile*, however, since when they are seen in a side view they are narrow but in a top view they are broad. The processes end in two horns in *T. gracile* while in this species there are often three.

Tetraedron lobatum polyfurcatum var. nov.

Cells four-sided, flat or pyramidal. Angles prolonged, tapering but slightly. Prolongations branching three to five times, ultimate branches with three spines. Prolongations nearly as long as cell. Sides of cell incurved.

Diameter (without processes) 20–15 μ; (with processes) 40–30 μ; diagonal diameter 50–35 μ.

PLATE 26, FIGS. 21, 22

DISTRIBUTION: plankton, Muskallonge and Pardee Lakes.

This may be classed as a variety of *T. lobatum* on account of the cell-shape, but the extensive system of rebranching apical prolongations is not found in any described variety of *T. lobatum*. The branches resemble *T. enorme* (Ralfs) Hansg. but the sides of the alga under consideration are too deeply incised and the corners of the cells too long to regard it as a variety of *T. enorme*.

Actinastrum gracillimum sp. nov.

Colonies of four or eight cells radiating from a common center. Cells elongate, cylindrical or slightly tapering. Chromatophore single, parietal, without a pyrenoid.

Cells 18–14 μ long, 2–1.75 μ wide.

PLATE 26, FIG. 23

DISTRIBUTION: plankton, Kegonsa and Mendota Lakes.

This is much more delicate than any previously described species of *Actinastrum*.

Cylindrospermum stagnale angustum var. nov.

Cells 4.5–4 μ wide; 10–8 μ long. Heterocysts 6.5–5.5 μ wide; 11–7 μ long. Spores 9–7 μ wide; 25–18 μ long.

PLATE 26, FIG. 24

DISTRIBUTION: bottom of Oconomowoc Lake.

The much narrower and shorter spores distinguish this from the type.

Spirulina laxa sp. nov.

Plant mass dark blue-green. Cells 2.5–2 μ wide, in a very loose spiral. Width of spiral 6–4 μ, distance between turns 20–15 μ. Cell contents blue-green.

PLATE 26, FIG. 25

DISTRIBUTION: along shore, Soft Lake.

The loose spiral suggests *Arthrospira* rather than *Spirulina* but, since a careful examination fails to reveal the presence of transverse walls, I am convinced the plant in question is a *Spirulina*.

Chroococcus limneticus distans var. nov.

Colonies spherical or ovoid, of four to thirty-two cells, rarely more, embedded in a copious, hyaline, unlamellated, gelatinous envelope. Cells hemispherical to spherical, with grayish or light blue-green contents, "gas vacuoles" rarely present.

Diameter of cells 7–6.5 μ; diameter of colonies up to 60 μ.

PLATE 26, FIG. 26

DISTRIBUTION: plankton, Cranberry and Muskallonge Lakes.

This *Chroococcus* variety has the characteristic *C. limneticus* Lemm. structure of a few spherical cells embedded in a wide gelatinous sheath. The cell-dimensions are different from those of the other *C. limneticus* varieties so that it seems best to regard it as a new variety.

Anabaena limnetica sp. nov.

Trichomes free-swimming, solitary, straight or slightly curved. Vegetative cells generally spherical, 10–14 μ in diameter, with "gas vacuoles." Heterocysts spherical, 10–12 μ in diameter. Spores smooth-walled, solitary, ovoid, adjacent to, or a short distance from, the heterocysts, 20–17 μ in diameter, 25–20 μ long.

PLATE 26, FIG. 27

DISTRIBUTION: plankton, Birch, Soft and Tamarack Lakes.

The species resembles *A. macrospora* Klebh. in the general appearance of the trichome, but the cellular dimensions are quite different, since the cells of *A. macrospora* are much smaller and the spores proportionally larger.

Lyngbya Birgei sp. nov.

Filaments free-floating, straight, rarely curved. Sheath firm, hyaline, homogeneous. Trichomes not constricted at cross walls, ends rounded but not attenuated. Cells shorter than broad, with many "gas vacuoles" at times.

Filaments 24–20 μ wide; trichomes 22–18 μ wide.

PLATE 26, FIG. 28

DISTRIBUTION: plankton, Kegonsa, Mendota, Monona, Oconomowoc, Squirrel and Waubesa Lakes.

Almost all of the true plankton species of *Lyngbya* have filaments that are less than 5 μ in diameter. The only other plankton species of any size is *L. Hieronymusii* Lemm., but the Wisconsin *Lyngbya* is much larger. This species is found in abundance in the Madison lakes and at times has been the major constituent of the "blooms" that have appeared in these lakes. This is especially the case in Lake Kegonsa. The cell contents at such times are very characteristic of "bloom"—producing Myxophyceae, since there are large numbers of reddish "gas vacuoles" in each cell. The species is named after Mr. E. A. Birge, Director of the State Survey.

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Explanation of plates 24–26

All the figures were drawn from life with the aid of the Abbé camera lucida, the drawings being made at the level of the base of the microscope. The Leitz objective 6 was used with the ocular 4, and the objective 1/16 with the oculars 1, 3 and 4. The magnifications are, respectively, 750, 1,000, 1,650 and 2,000 diameters. The drawings have been reduced a little more than one half (to eleven twenty-fourths their original size) in reproduction.

PLATE 24

FIG. 1. *Chaetosphaeridium ovalis* G. M. Smith, ×345.
FIG. 2. *Oocystis panduriformis minor* G. M. Smith, ×920.
FIG. 3. *Tetrastrum apiculatum* (Lemm.) Brunnthaler, ×920.
FIGS. 4–6. *Characium stipitatum* (Bachmann) Wille, ×920.
FIG. 7. *Kirchneriella elongata* G. M. Smith, ×920.
FIG. 8. *Schroederia setigera* (Schröder) Lemm., ×920.
FIGS. 9–11. *Schroederia Judayi* G. M. Smith, ×920.
Fig. 12. *Gloeocystopsis limneticus* G. M. Smith, ×920.

PLATE 25

FIG. 13. *Pediastrum sculptatum* G. M. Smith, ×460.
FIG. 14. *Pediastrum araneosum rugulosum* (G. S. West) G. M. Smith, ×920.
FIG. 15. *Peroniella planctonica* G. M. Smith, ×920.
FIG. 16. *Chodatella ciliata minor* G. M. Smith, ×920.
FIG. 17. *Micractinium quadrisetum* (Lemm.) G. M. Smith, ×920.
FIG. 18. *Micractinium pusillum* Fresenius, ×920.

PLATE 26

FIGS. 19, 20. *Tetraedron planctonicum* G. M. Smith, ×920.
FIGS. 21, 22. *Tetraedron lobatum polyfurcatum* G. M. Smith, ×920.
FIG. 23. *Actinastrum gracillimum* G. M. Smith, ×920.
FIG. 24. *Cylindrospermum stagnale angustum* G. M. Smith, ×920.
FIG. 25. *Spirulina laxa* G. M. Smith, ×920.
FIG. 26. *Chroococcus limneticus distans* G. M. Smith, ×760.
FIG. 27. *Anabaena limnetica* G. M. Smith, ×760.
FIG. 28. *Lyngbya Birgii* G. M. Smith, ×760.

A quantitative study of the factors influencing the weight of the bean seed—II. Correlation between number of pods per plant and seed weight

J. Arthur Harris

(with four text figures)

I. Introductory remarks

This study, like the one which preceded it,* presents a portion of the results of an attempt to express in quantitative terms the influence of the various differentiable factors to which the weight of the bean seed is due.

Such an investigation has a three-fold significance: (*a*) it has the biological interest common to studies in developmental mechanics; (*b*) it forms a part of the system of physiological data on seed production which can never be too detailed or precise as a foundation for economic science; (*c*) it pertains to a character which through the theories of Johannsen and his followers has assumed a prominent place in genetic literature.

In the first paper I considered the correlation between the characteristics of the pod (number of ovules laid down, number of seeds matured, and position of seed in the pod) and seed weight. In this place I propose to deal with the problem of the relationship between the size of the plant, as measured by the number of fertile pods produced, and seed weight. These constants will be compared with these showing the relationship between the number of pods per plant and pod characteristics, already published.

II. Materials and methods

The materials upon which the present discussion are based comprise 78,975 individually weighed seeds, derived from 15,897 plants, belonging to 27 experimental cultures, representing 5

* Harris, J. Arthur. A quantitative study of the factors influencing the weight of the bean seed. I. Intra-ovarial correlations. Beih. Bot. Centralbl. **31**[1]: 1–12. *pl. 1–4.* 1913. See also: The influence of position in the pod upon the weight of the bean seed. Amer. Nat. **49**: 44–47. *f. 1–4.* 1913.

varieties. These cultures were made under a wide range of environmental conditions. They are here designated by the key letters employed in other publications. It is, therefore, unnecessary to burden this paper with information which the reader who cares to do so may obtain elsewhere.*

The biometric methods employed in the analysis of the data should now be familiar in a general way to all serious biological workers.†

III. PRESENTATION AND DISCUSSION OF DATA

The physical constants for the unweighted frequency distributions of both number of pods per plant and weight of seed have been given elsewhere.‡

The weighted frequency constants have little independent biological interest. We may, therefore, limit our attention to the degree of interdependence between the two variables.

The correlation coefficients for number of pods and seed weight with their probable errors and their ratios to their probable errors appear in TABLE I.

The regression straight line equations giving the numerical equivalents of

$$w = \left(\bar{w} - r_{pw}\frac{\sigma_w}{\sigma_p}\bar{p}\right) + r_{pw}\frac{\sigma_w}{\sigma_p}p,$$

where the bars denote means and the sigmas represent the standard deviations of the characters indicated by the subscripts are given in TABLE II. These show the absolute change in seed weight associated with unit change in number of pods per plant. If the regression straight lines and the empirical mean seed weights for plants with various numbers of pods for a number of series be

* See a bibliography in Amer. Jour. Bot. 1: 410–411. 1915.

† Number of pods per plant is an integral variate which has been treated without grouping. Seed weight has been dealt with in classes of 0.025 gram range, e.g. 0.175–0.200, 0.200–0.225, 0.225–0.250. Sheppards' correction was applied to the second moment for seed weight but not to that for number of pods per plant. Number of pods per plant was of course weighted with number of seeds weighed per plant.

‡ These are sometimes based upon slightly different numbers than these here employed, but the constants are sensibly the same.

TABLE I

Series	Number of Plants	Number of Seeds Weighed	Correlation Pods and Weight	r/E_r
L	185	2861	.157±.012	13.08
LL	1141	3947	.074±.011	6.73
GG	747	8364	.055±.007	7.86
GGH	583	2828	.173±.012	14.42
GGH_2	499	1284	.081±.019	4.26
GGHH	396	1329	.039±.019	2.05
GGD	514	2140	.150±.014	10.71
GGD_2	449	1419	.240±.017	14.12
GGDD	342	1093	.193±.020	9.65
H	160	5778	.145±.009	16.11
HH	1484	7325	.191±.008	23.87
HHH	1271	5601	.264±.008	33.00
HD	1416	6630	.303±.008	37.87
HDD	1204	5029	.171±.009	19.00
D	445	2362	.031±.014	2.21
DD	513	2362	.339±.012	28.25
DDD	459	1946	.077±.015	5.13
DH	670	3222	.221±.011	20.09
DHH	565	2433	.307±.012	25.58
USH	361	1164	.154±.019	8.11
USHH	224	530	.108±.029	3.73
USD	312	1002	.282±.020	14.10
USDD	237	789	.210±.023	9.13
FSH	476	2117	.005±.015	.33
FSHH	429	1788	.053±.016	3.31
FSD	428	1989	.205±.015	13.66
FSDD	387	1643	.069±.017	4.06

expressed graphically on the same diagram, as in FIGS. 1 and 2,* the results seem very irregular indeed. This lack of uniformity appears in both the varying slope of the lines and in the scatter of the observed means about these lines.

The variation in the slope of the lines must be considered in relation to the great diversity in environmental conditions under which the plants were grown.

The slope of the line is determined solely by the magnitude of the absolute variation constants for seed weight and number of pods per plant and the correlation between them. The standard deviation of seed weight is relatively little influenced by the differences in environmental conditions obtaining between the cultures here considered. The standard deviation of number of pods per plant varies greatly from experiment to experiment. Thus with the same degree of correlation, the actual rate of change in seed

* In order to accommodate as large a series as possible of figures on the same diagram the marginal scales have been given no numerical values. The numbers of pods and the end points of the lines drawn are given in the table.

TABLE II

Series	Regression Equation	End Points of Line
L	$W = .3522 + .0023\ P$	1 = .354, 31 = .422
LL	$W = .3291 + .0012\ P$	1 = .330, 27 = .360
GG	$W = .4167 + .0012\ P$	1 = .418, 26 = .447
GGH	$W = .4298 + .0027\ P$	1 = .433, 33 = .543
GGH$_2$	$W = .4427 + .0022\ P$	1 = .445, 17 = .479
GGHH	$W = .4409 + .0010\ P$	1 = .442, 15 = .456
GGD	$W = .3385 + .0079\ P$	1 = .347, 8 = .402
GGD$_2$	$W = .3609 + .0128\ P$	1 = .374, 7 = .451
GGDD	$W = .3670 + .0111\ P$	1 = .378, 9 = .456
H	$W = .2127 + .0007\ P$	1 = .214, 46 = .246
HH	$W = .2184 + .0008\ P$	1 = .219, 67 = .271
HHH	$W = .1825 + .0017\ P$	1 = .184, 34 = .241
HD	$W = .1772 + .0058\ P$	1 = .183, 14 = .258
HDD	$W = .2102 + .0027\ P$	1 = .213, 16 = .253
D	$W = .1723 + .0008\ P$	1 = .173, 9 = .180
DD	$W = .1757 + .0065\ P$	1 = .182, 14 = .266
DDD	$W = .1976 + .0014\ P$	1 = .199, 13 = .216
DH	$W = .1961 + .0009\ P$	1 = .197, 50 = .239
DHH	$W = .1797 + .0020\ P$	1 = .182, 27 = .232
USH	$W = .3182 + .0017\ P$	1 = .320, 39 = .385
USHH	$W = .3018 + .0019\ P$	1 = .305, 15 = .331
USD	$W = .2243 + .0108\ P$	1 = .235, 7 = .300
USDD	$W = .2806 + .0049\ P$	1 = .286, 16 = .358
FSH	$W = .2001 + .0000\ P$	1 = .200, 50 = .201
FSHH	$W = .1645 + .0003\ P$	1 = .165, 34 = .175
FSD	$W = .1501 + .0032\ P$	1 = .153, 10 = .182
FSDD	$W = .1632 + .0012\ P$	1 = .164, 14 = .179

W = Weight in grams, P = Pods per plant. End points of lines give calculated mean seed weight in grams for number of pods indicated.

weight will vary widely because of differences in the variability of number of pods per plant.

The irregularity of the means of seed weight for plants with different numbers of pods is attributable to several factors. Note the following:

Taken as a whole the correlations are of a very low order. In such cases the empirical means must be expected to deviate considerably from the theoretical means as predicted from the regression formula unless the number of observations be very large indeed.

Number of pods per plant is an exceedingly variable character. In consequence, the means for seed weight must, in experiments made under favorable conditions, be based upon a relatively small number of seeds, even in series in which the total number of seeds weighed is very large. It is impossible, if all series are to be treated alike, to increase the number of seeds upon which means

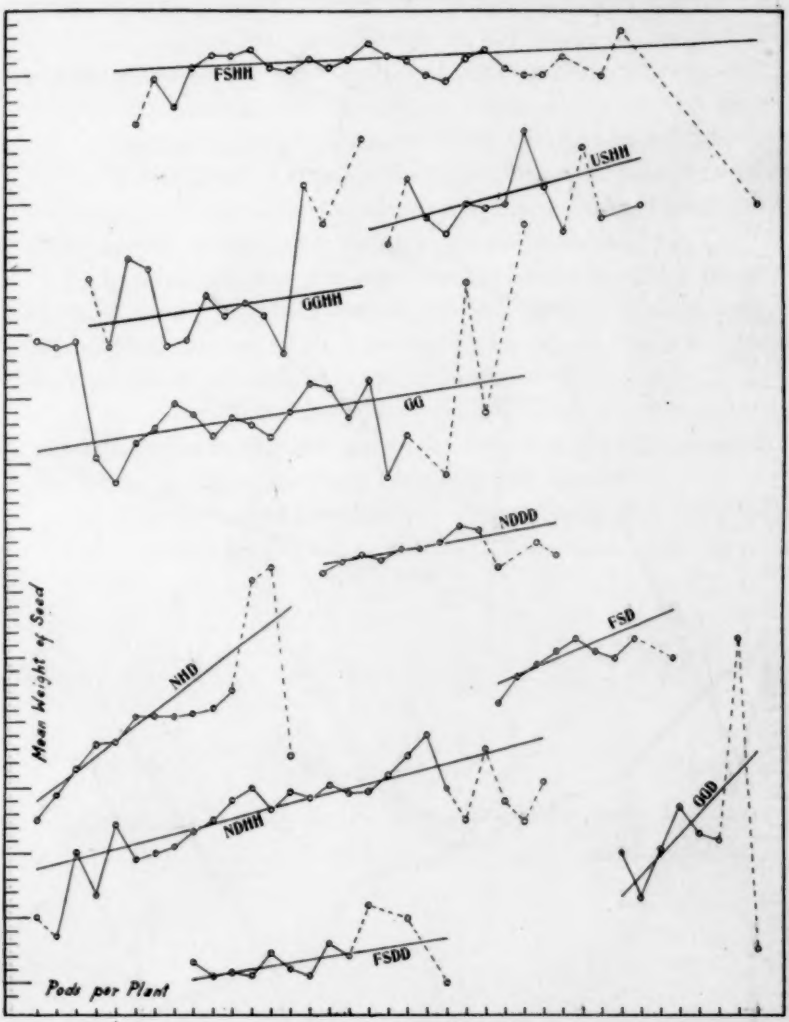

FIG. 1. Regression straight lines showing change in seed weight associated with variation in number of pods per plant.

are based by clubbing together plants with similar numbers of pods, since in many of the experiments the range of variation is too narrow to permit of such combination.

Finally, it is to be noted that in general about five seeds per plant have been weighed. When the number of plants with a

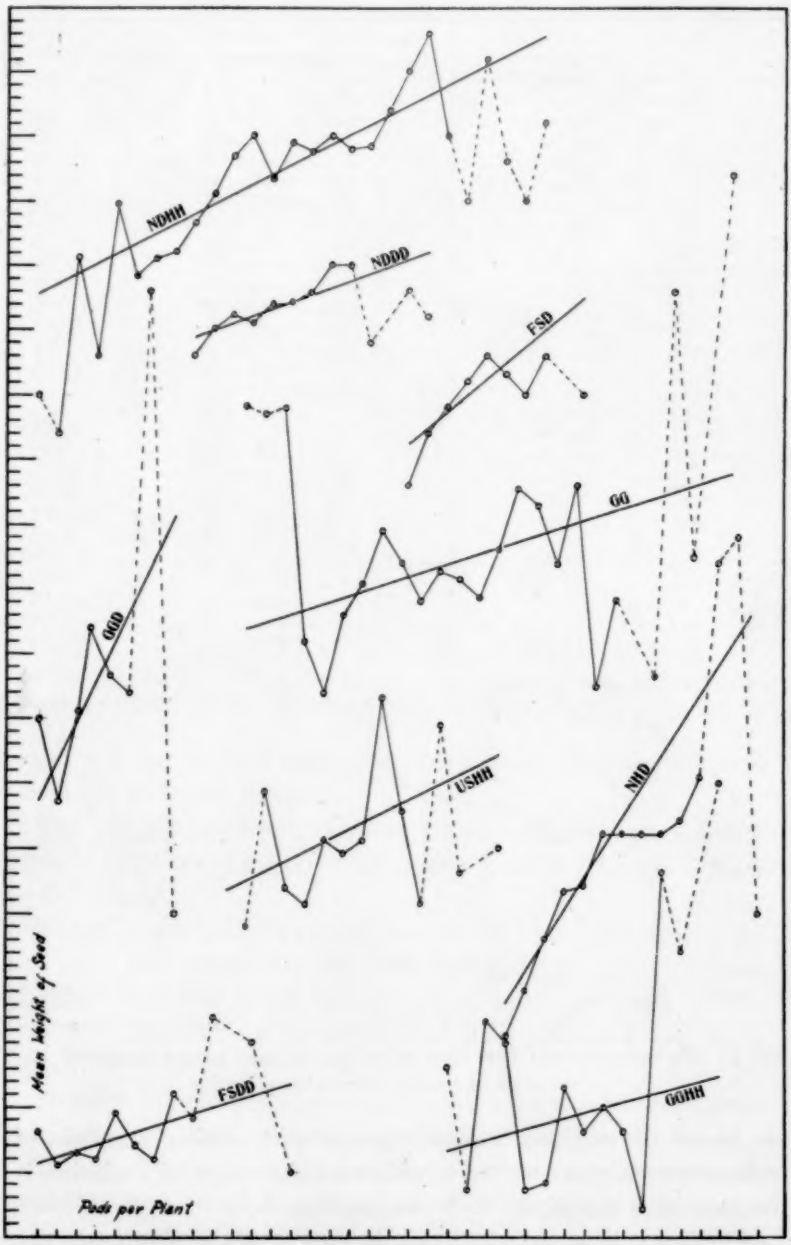

FIG. 2. Regression of seed weight on number of pods per plant. See explanation of FIG. 1.

given number of pods is small, this weighting will, I believe, tend to result in abnormal irregularity of the means of arrays. The biological reason for this condition I hope to discuss later.

Notwithstanding the conspicuous irregularity of the means, the number of regression diagrams in the two figures indicate that, taken by and large, a straight line represents the change in mean seed weight associated with variation in the number of pods on the plant as well as any other single equation would do.

It is quite idle to apply mathematical tests for goodness of fit in these series, for these involve the calculation of a measure of interdependence which is greatly influenced by the special difficulties which are met in graphical tests for linearity.

Thus, notwithstanding difficulties inherent in the materials the correlation coefficient seems the best numerical expression of the degree of interdependence between the variables.

All of the 27 values are positive. Numerically they are of a low

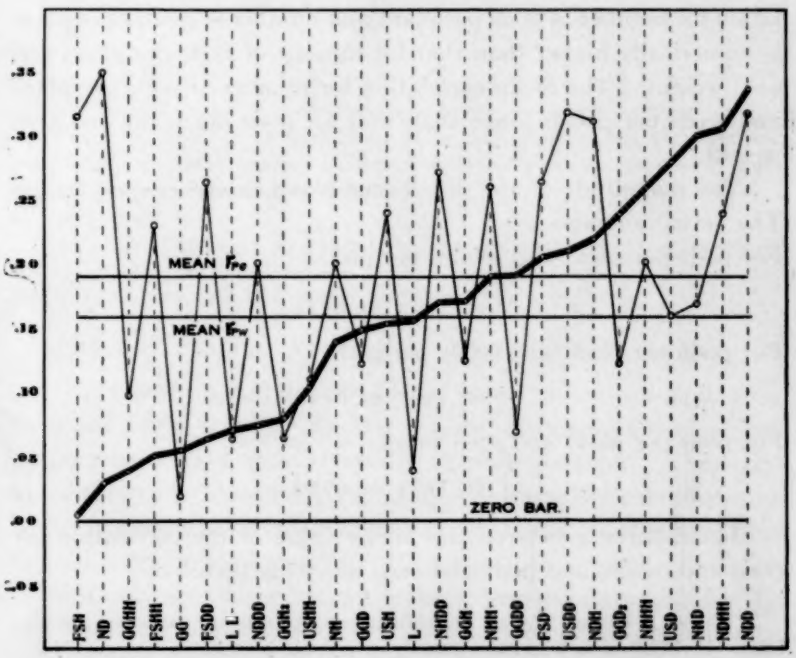

FIG. 3. Comparison of correlations between number of pods per plant and seed weight with that between number of pods per plant and number of ovules per pod in 27 cultures of *Phaseolus*.

order, ranging from +.005 to +.339 with the average value +.159. With two or three exceptions only, the correlation coefficients may be considered statistically significant in comparison with their probable errors.

As a basis of comparison there are available from an earlier paper* the constants showing the relationship between the number of ovules and seeds per pod and the number of pods per plant in these same series.

The results are exhibited graphically in FIGS. 3 and 4. In these the circles on the ordinates joined by the heavy lines show on the scale to the left the values of the correlations for number of pods per plant and seed weight arranged in the order of their magnitude. The circles connected by the narrow lines show on the same scale the magnitude of the correlations for ovules and seeds respectively.

The bars indicating the averages show that the mean correlation for number of pods per plant and number of ovules per plant is numerically higher than that for number of pods per plant and seed weight. The mean correlation for number of pods per plant and seeds per pod is lower than that for pods per plant and seed weight.

The magnitude of the differences is not, however, very large. The actual averages are:†

For pods per plant and ovules per pod,

$$r = .1924 \pm .0124.$$

For pods per plant and seeds per pod,

$$r = .1327 \pm .0118.$$

For pods per plant and seed weight,

$$\bar{r} = .1592 \pm .0119.$$

The difference between the mean value of the correlation for pods and ovules and pods and seed weight is therefore

* Harris, J. Arthur. On the correlation between somatic characters and fertility. II. Illustrations from *Phaseolus vulgaris*. Amer. Jour. Bot. 1: 398–411. 1914.

† The mean values of the correlations for pods and ovules and pods and seeds given here differ slightly but insignificantly from those published elsewhere, because only 27 of the 32 series are used here.

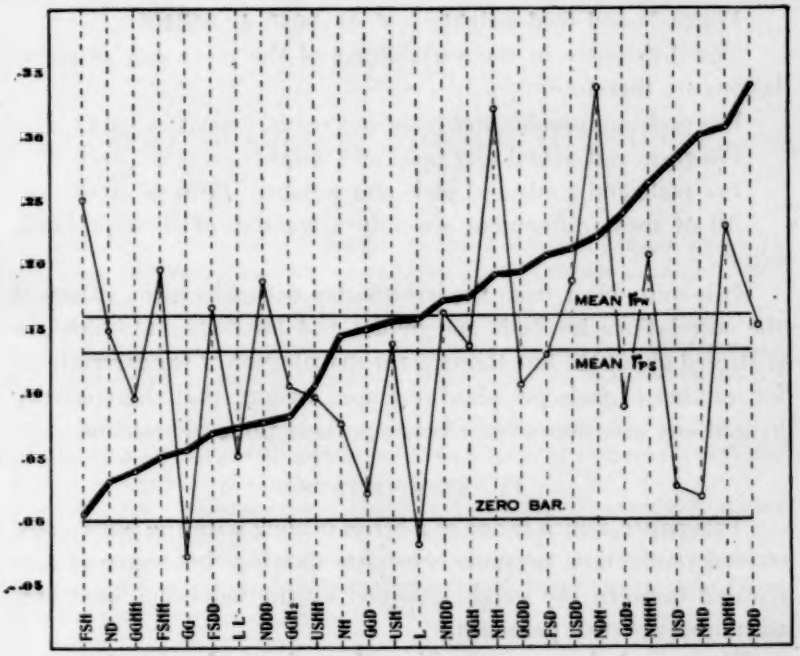

FIG. 4. Comparison of correlations between number of pods per plant and seed weight with that between number of pods per plant and number of seeds matured per pod in 27 cultures of *Phaseolus*.

$$(.1592 - .1924) \pm \sqrt{(.0119)^2 + (.0124)^2} = -.0332 \pm .0172,$$

while that for pods and seeds and pods and weight is

$$(.1592 - .1327) \pm \sqrt{(.0119)^2 + (.0118)^2} = .0265 \pm .0168.$$

Differences in correlations of the order of .03 can ordinarily be given little weight. In the present instance neither of the differences is quite twice as large as its probable error. They cannot therefore be asserted to represent real physiological differences in the closeness of interdependence of the magnitudes of the three variables under consideration.

Not only are the means of the three correlations essentially the same, but the variability of the three sets of constants is practically identical. The values are:

For pods and ovules per pod, $\sigma_r = .0953 \pm .0087$.

For pods and seeds per pod, $\sigma_r = .0906 \pm .0083$.

For pods and seed weight, $\sigma_r = .0916 \pm .0084$.

The differences in the variabilities of the three sets of correlations are therefore:

For pods and ovules and pods and seeds, $.0047 \pm .0117$.

For pods and ovules and pods and weight, $.0037 \pm .0118$.

For pods and seeds and pods and weight, $.0010 \pm .0118$.

All of these differences are only a fraction of their probable errors.

It is quite clear from the irregularity with which the values of the correlations for pods and ovules and for pods and seeds are scattered about the line showing the distribution of the correlations for number of pods per plant and seed weight, that there is very little if any interdependence between these three correlations.

IV. RECAPITULATION

This paper, which is one of a series dealing with the physiology of seed production, presents constants showing the degree of correlation between the weight attained by the individual seed and the number of pods per plant.

The correlations are positive throughout the twenty-seven series for which data are available, but are of a low order of magnitude and highly variable. They range from $+.005$ to $+.339$, with a mean of $+.159 \pm .012$ and an absolute variability of $.092 \pm .008$.

In both average magnitude and variability the correlations for seed weight and number of pods per plant are in excellent agreement with those for number of ovules per pod and number of pods per plant and with the correlation for number of seeds per pod and number of pods per plant.

The average value of the correlation for pods and weight is lower than that for pods per plant and ovules per pod and higher than that for pods per plant and seeds per pod, but both of these differences are low, and may not be significant in comparison with their probable errors.

These studies will be continued.

COLD SPRING HARBOR, NEW YORK.

INDEX TO AMERICAN BOTANICAL LITERATURE

1913-1916

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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Andrews, A. L. Two extensions of range. Bryologist **19**: 37, 38. 26 My 1916.

Sphagnum Dusenii from British Columbia, and *Rhabdoweisia crispata* from North Carolina.

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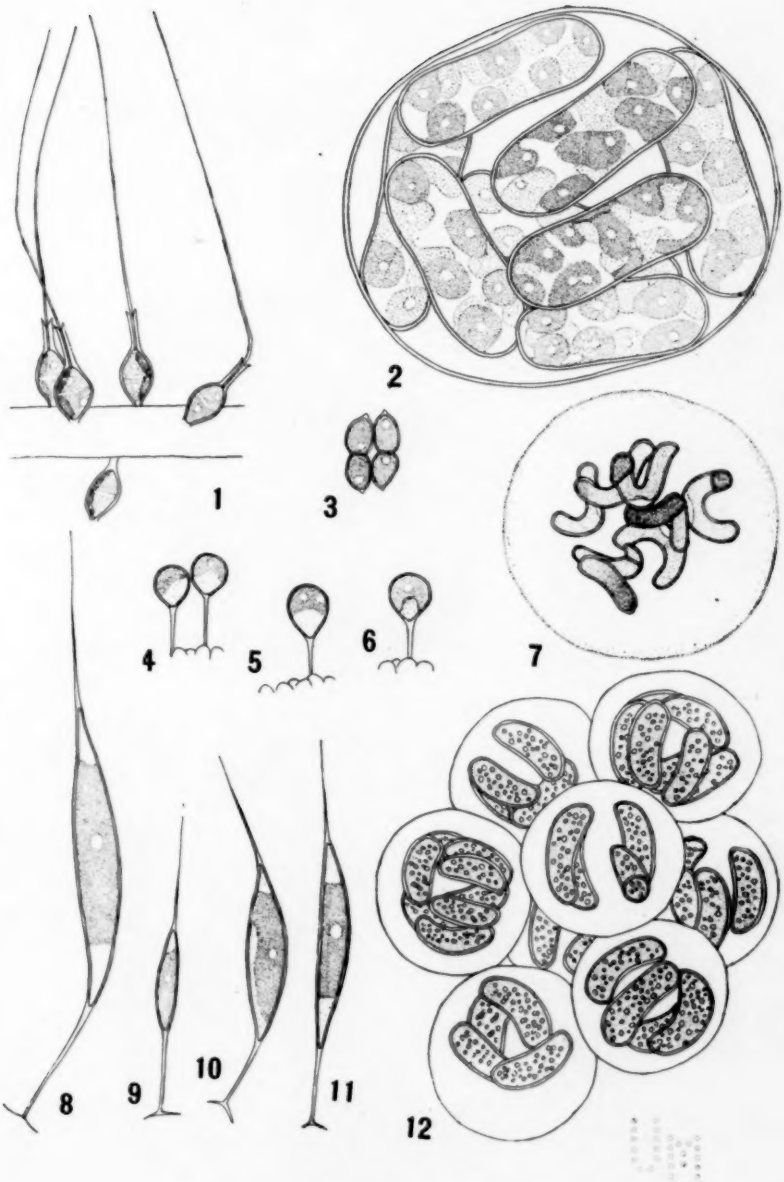
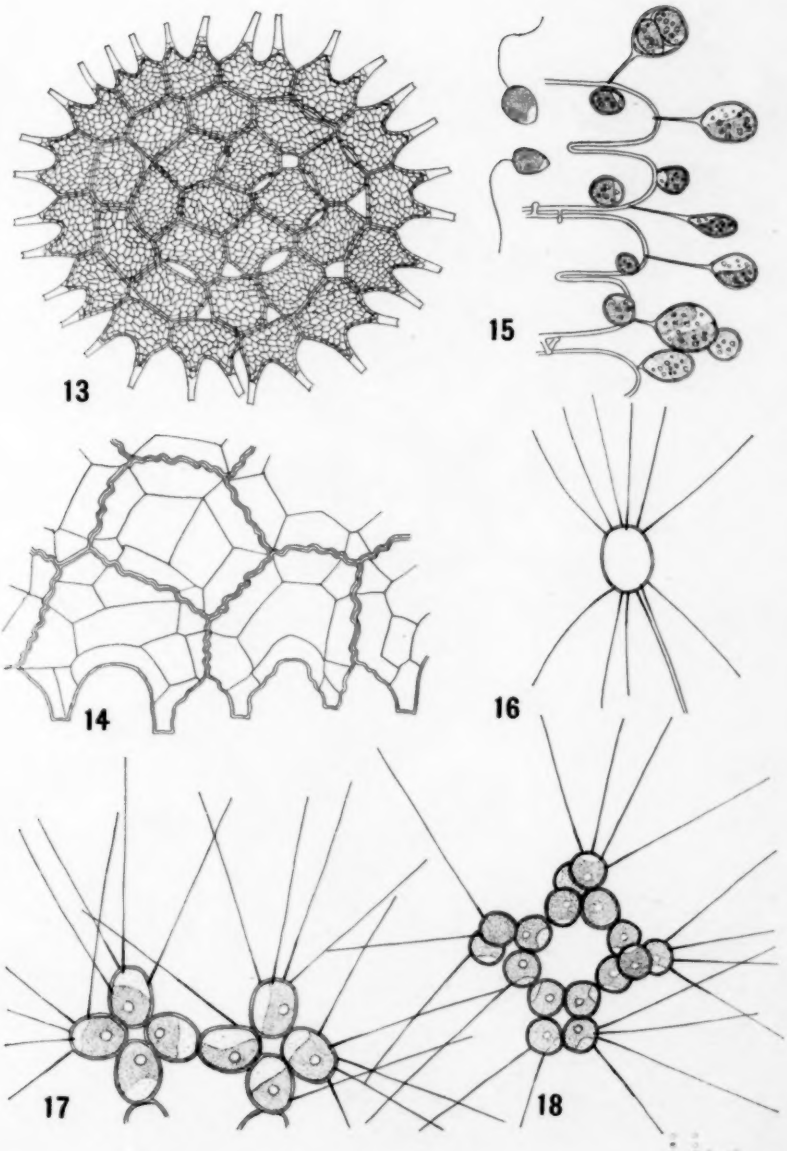


G. M. SMITH: WISCONSIN ALGAE



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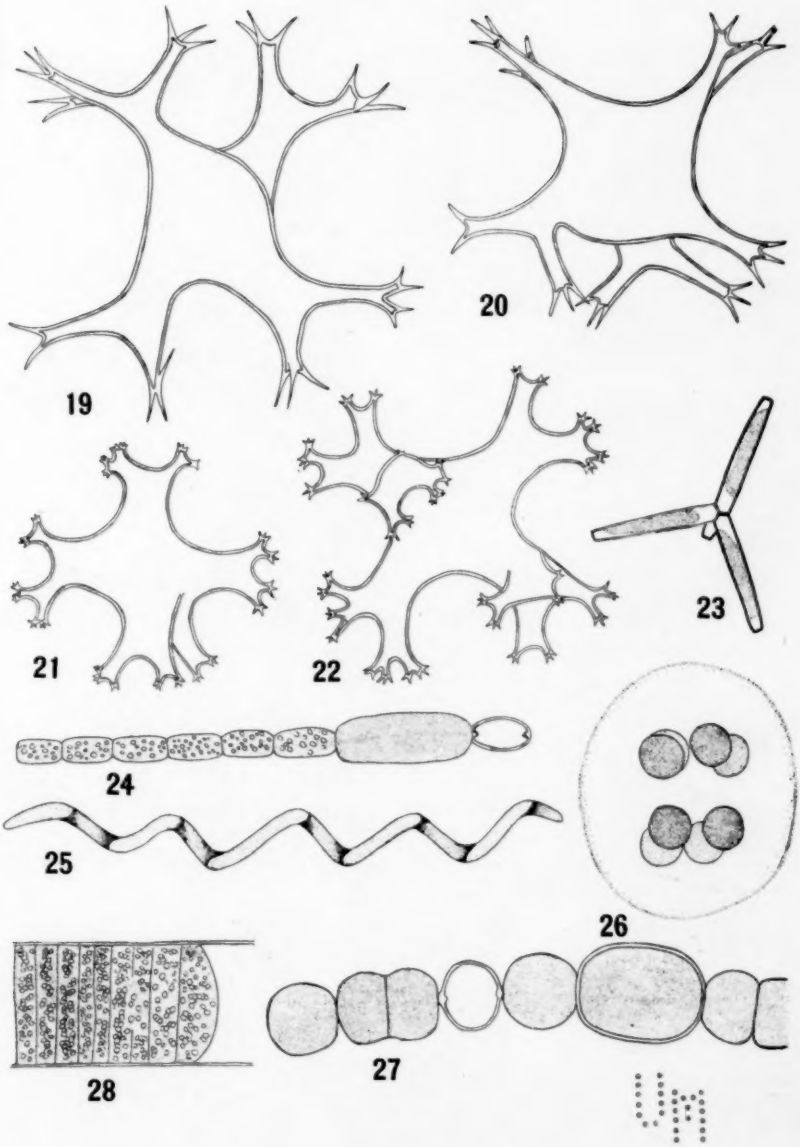

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